Infoteca's E-Journal

An Electronic Compilation of Scientific and Cultural Information by
Sistema de Infotecas Centrales, Universidad Autónoma de Coahuila

CONTENTS

Leaks

By BEN ZIMMER

When is a leak not a leak? Last month's release of the Afghan war logs — tens of thousands of classified documents unveiled by the Web site WikiLeaks — stretched the semantics of *leak* to a bursting point.

"The word 'leak' just doesn't seem adequate for a data dump and security breach of this magnitude," wrote Peter Feaver, a professor of political science at Duke University, in a blog post for Foreign Policy. "This is not so much a leak as a gusher." Jack Shafer of Slate concurred: "To call the torrent of information about the Afghanistan war released by WikiLeaks a mere leak is to insult the gods of hydrodynamics."

Our canonical images of leakiness involve liquid seeping out through small openings in something — a dripping faucet, a roof letting in rain, a boat with a cracked hull. Physical leaks can be stopped with a patch or some other reinforcement, as when the little Dutch boy plugged that faulty dike with his finger. But political leaks have strayed far from their literal foundation.

The metaphor of confidential information leakingout is, in fact, an ancient one. In "The Eunuch," a comedy by the Roman playwright Terence from the second century B.C., one character says of his inability to keep a secret, "I am full of holes, I leak at every point" ("Plenus rimarum sum, hac atque illac perfluo"). In English, blabby talkers (stereotypically women) have been called *leaky* since the late 17th century. And the phrasal verb *leak out* has been used for the revelation of secrets since at least 1806, when the British journalist William Cobbett, an advocate for parliamentary reform, wrote, "When any valuable information leaks out, let us note it down."

An early glimpse of how *leak* entered American political vocabulary comes in John C. Frémont's 1887 memoirs, which recount a political event leading up to the Mexican-American War, when Secretary of State James Buchanan "discovered a leak in his department." Buchanan needed to patch a leak from below, but by the end of World War II, leaks could just as likely come from above, in the form of information revealed to reporters by high-ranking officials who didn't want to be identified. As James Reston wrote in a 1946 New York Times dispatch on postwar peace negotiations, "Governments are the only vessels that leak from the top."

Reston's observation rang true with Daniel Schorr, the veteran newsman who died last month at 93. Schorr was an old hand at the leaking game, having reported for CBS News on the damaging disclosures that befell the Nixon administration, from Daniel Ellsberg's release of the Pentagon Papers to the Watergate secrets passed on to The Washington Post by Mark Felt, known at the time only as Deep Throat. (Nixon's would-be leak-pluggers, the "plumbers," only made matters worse, of course.)

Schorr lost his job at CBS over a leak, which he described in his autobiography, "Staying Tuned," as "the most tumultuous experience of my career." In 1976 he received a draft copy of a secret House Intelligence Committee report on illegal C.I.A. and F.B.I. activities, which he in turn leaked to The Village Voice. Schorr was revealed as The Voice's source, but he refused on First Amendment grounds to divulge who gave him the report.

A keen observer and instigator of Washington leaks, Schorr was equally perceptive about the word *leak* itself. "Originally, when information 'leaked,' " he was quoted as saying by William Safire in a 1982 On Language column, "it was thought of as an accidental seepage — a lost document, a chauffeur's unwary anecdote, loose lips in the Pentagon. Today, when information 'is leaked,' it is a witting (if sometimes witless) action. One leaks (active) to float or sink an idea, aggrandize self (the 'senior official on the secretary's plane') or derogate an opponent."

It was astute of Schorr to spot the transformation of *leak* into an active, intransitive verb with the source of information as the subject. The usage isn't entirely new — for example, an 1897 article in The Daily Argus News of Crawfordsville, Ind., referred to attempts to find "the man that 'leaked' about the blackballing" of Gov. James A. Mount. But in modern political parlance, it's not necessary to say that someone "leaked something" or even "leaked about something"; the verb can stand alone. When private postings from the e-mail list JournoList got some unwelcome exposure in June, a headline on Politico read, "JournoList wonders who leaked."

Schorr died two days before the mother of all leaks made the news, when The New York Times and other papers published reports based on the WikiLeaks data dump from Afghanistan. In its very name, WikiLeaks marries old-fashioned political leaking with Web 2.0 methods of sharing information in a collaborative, bottom-up wiki style. (The original "wiki," even before Wikipedia, was WikiWikiWeb, named in 1995 by the computer scientist Ward Cunningham after the Hawaiian word for "fast" — inspired by Honolulu International Airport's Wiki Wiki Shuttle.)

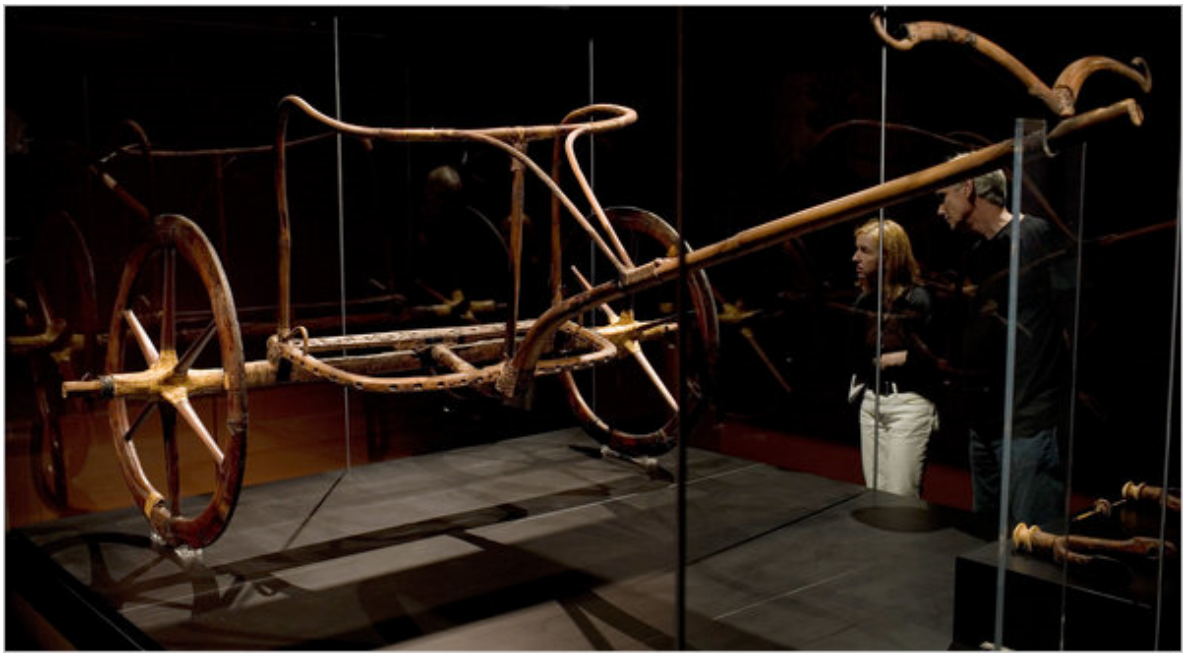
Do we need new terminology for leaking on such an immense scale? Perhaps we can take a cue from linguistic debates over BP's notorious oil-well blowout in the Gulf of Mexico. After the catastrophic extent of April's accident became apparent, puny words like *spill* and *leak* suddenly seemed inadequate to many commentators. Wendalyn Nichols, editor of the newsletter Copyediting, proposed *rupture* as an alternative label, evoking "a wound that can't clot, that is not self-healing." With WikiLeaks capable of uploading even more classified material from the Afghan theater, the rupture in our wartime intelligence apparatus may prove equally difficult to repair.

Ben Zimmer will answer one reader question every other week. Send your queries to onlanguage@nytimes.com. You can follow Mr. Zimmer on Twitter at twitter.com/OnLanguage.

http://www.nytimes.com/2010/08/22/magazine/22FOB-onlanguage-t.html?ref=magazine

King Tut's Chariot Arrives in Times Square

By RANDY KENNEDY



As 18th-Dynasty pharaohs' chariots go, the one that arrived in Times Square on Friday night was not a Mercedes or a Bentley. There was no gold leaf or fine animal-fur interior or richly appointed cartouche-ing. It was more like a teenager's dragster stripped down for speed, just a lightweight frame of tamarisk, elm and birch, missing only its two-horsepower engine.

Late on Sunday night, in a subterranean exhibition space on West 44th Street, a group of gloved art handlers — under the wary supervision of Sanaa Ahmed Ali, director of the Luxor Museum in Egypt — opened a wooden crate, unpacked the left wheel and slowly slid it onto the axle where it had once turned. An hour later they did the same with the right wheel. Then everyone in the room fell silent for a moment, looking at the result, before breaking into applause.

"Boy, that's amazing," said Mark Lach, a senior vice president of Arts and Exhibitions International. "Really just amazing."

Though there were much fancier ceremonial chariots among the six discovered, in 1922, in the tomb of King Tutankhamen (as his name is often spelled), this one — to be unveiled on Tuesday as a late, crowd-luring addition to "Tutankhamun and the Golden Age of the Pharaohs," the commercial exhibition of Tut treasures at the Discovery Times Square Exposition — is considered uniquely amazing by scholars because it is the only one that shows signs of wear and tear. So it has long been thought that it was the chariot actually used by the boy king for battle or, more likely, for hunting.

And with recent forensic and DNA examinations showing that Tut suffered from a degenerative bone disease and could have died from complications of malarial infection after he broke his leg in a fall, the chariot has

taken on new importance as the centerpiece of a theory that it might have been the instrument of his premature death, before the age of 20.

"I think it's one of the best solutions to the mystery so far," said David P. Silverman, a chief curator at the University of Pennsylvania Museum of Archaeology and Anthropology and the curator of the traveling Tut exhibition. Given the weakness of the king's bones, "it is possible that he might not have been able to stay in the chariot as well as he should have, and it is possible that he might have fallen out and broken his leg."

Mr. Silverman allowed that this was not quite as sexy as the previous theory that the king was murdered (based mostly on an erroneous interpretation of a hole at the back of his skull, one actually made after his death for the mummification process).

"It doesn't make for such good television — everybody likes intrigue and betrayal, I guess," he said. "But it does make more sense."

The plan to send the chariot to New York — its first trip out of Egypt since its creation 3,300 years ago — was initiated by Zahi Hawass, the colorful general secretary of Egypt's Supreme Council of Antiquities, who is now the star of his own reality show on the History channel, "Chasing Mummies," and a wily promoter of both himself and his country's archaeological riches.

In a telephone interview from Cairo he said that he had decided to embark on the lengthy process of seeking approval for the fragile chariot to travel because he felt it was an important element in the story of Tut's life and maybe his death, a kind of grand utilitarian artifact not seen in the legendary 1970s Tut tour. But Mr. Hawass added unabashedly that the most important reasons for its addition were attention, attendance and money.

The show's tour, which began in Los Angeles in 2005 and ends in New York on Jan. 2, after passing through six other cities, has raised more than $100 million to be used for the improvement of Egypt's museums and its archaeological sites. And Mr. Hawass said he believed that displaying the chariot — and turning the exhibition into the ultimate B.C. car show — would guarantee a packed house through the fall and winter.

"It's a gift to the people of New York," he said. "And we hope they will give us a gift as well." (Neither he nor the exhibition's other organizers have released to-date attendance numbers for the New York leg of the tour, though they said the overall attendance since the tour began is about eight million visitors.)

The chariot was expected to be part of the New York show when it opened in April but was held up as conservators, antiquities officials and Egyptian officials debated whether it was sturdy enough to travel. A separate room and a huge, climate-controlled glass case were built into the exhibition, but they remained curtained off as dates came and went for the chariot's arrival.

Finally, last week, the disassembled vehicle, having made its way by truck from the Luxor Museum to Cairo, was put aboard a Lufthansa cargo jet, accompanied by Nemat Mousa, a curator at the Egyptian Museum in Cairo. The two managed to get all the way to John F. Kennedy International Airport before being stopped by one last logistical hurdle.

When New York traffic officials reviewed the papers required for the oversize truck that would transport the chariot into Manhattan, they saw that the cargo inside was classified as a vehicle, and demanded its Vehicle Identification Number.

“I’m totally serious,” said Mr. Lach, the exhibition’s designer. “But we got it cleared up.”

A special lift was constructed inside the exhibition space — once the printing floor and paper-storage rooms for The New York Times — and on Saturday the chariot’s crates were brought into a clean room, where they were opened so the condition of the contents could be assessed.

“I was a little bit scared, I must admit,” said Ms. Ahmed, who came to oversee the chariot’s reassembly with Amany Emiel Nashed, a conservator from the Luxor Museum. “Many people say that this chariot should not leave Egypt, and you worry. But then I saw it and I knew that everything was O.K. and I breathed.”

She and her colleagues worked on the installation until 4 a.m. on Sunday. (Most of the work had to be done at night because the exhibition’s organizers did not want to lose money by closing for installation.)

By 9:30 on Sunday night, as the strains of melodramatic music wafted in from the exhibition’s speakers lent an air of Indiana-Jones-like suspense, the chariot’s wheels were secured to the axles with the tiny original wooden pins that had been found in the tomb. After being let go, the left wheel spun a few inches on its own. Ms. Mousa gasped quietly and reached out for it, thinking it might fall, but it quickly stopped moving and was determined to be secure.

By 10:45, the back of the chariot was lowered gingerly from the white wooden jacks that kept it up off the base of the platform. The whole thing could have rolled if not for the transparent wedges pushed in front of and behind its wheels to keep it in place.

“Nice job, people,” Mr. Lach announced. “That’s it for tonight. Tomorrow we bring in the horses.”

“Tutankhamun and the Golden Age of the Pharaohs” continues through Jan. 2 at Discovery Times Square Exposition, 146 West 44th Street, Manhattan; (888) 988-8692 or discoverytsx.com.

http://www.nytimes.com/2010/08/03/arts/design/03chariot.html?ref=design

A Font of Ideas From a 'Nomadic' Humanitarian Architect

By ALICE RAWSTHORN

This time last week, Nathaniel Corum was on a Navajo reservation in Arizona where three elders' families were moving into new solar-powered homes that he'd designed to be built from straw bales. Next came the news that the Plastiki, a boat made from 12,500 recycled plastic bottles for which he'd designed the cabin, had docked safely in Sydney after a 130-day voyage across the Pacific to protest against plastic waste.

He's starting this week in San Francisco, where he is helping Architecture for Humanity, the volunteer network, to plan a reconstruction program in Haiti. Now 43, Mr. Corum has worked on humanitarian design projects like these for a decade, helping people living on the margins of society, such as the Navajo elders, or those whose lives have been shattered by the Haiti earthquake and other disasters.

He doesn't have a partner, kids or even a home in the conventional sense. "AfH is my hub," he explained. "I have a place in the Bay Area, but I consider myself nomadic." Traveling from place to place, he communicates with collaborators, family and friends on social networking sites and on AfH's Open Architecture Network from a portable workstation containing a military standard computer, which is waterproof, shockproof and so crush proof that a car could drive over it.

An obscure field when he joined it, humanitarian design is now one of the most dynamic — and controversial — areas of design. Bruce Nussbaum, an influential American design commentator, recently posted a blog entitled: "Is humanitarian design the new imperialism?" in which he accused some humanitarian designers of imposing well-meant, but inappropriate solutions on developing countries.

Unsurprisingly, Mr. Corum rebuffs the charge. "The richer the dialogue you have with the people you're working with the better," he said. "I spend lots of time with them, and learn so much, especially from people living close to the land. Humanitarian design isn't the new imperialism, it's the new compassion."

Born in Boston, and raised in Vermont, he studied product design at Stanford University, then went into commercial design. "I worked with some great firms, but found we were shopping for gold-plated fixtures," he recalled. "I felt like a personal shopper or glorified manicurist. The work wasn't as meaningful as I wanted it to be."

What he wanted was to experiment with the sustainable lifestyle he'd experienced as child living on a farm in Vermont with his English professor father and social worker mother. After taking an architecture degree at the University of Texas, he won a Fulbright Scholarship to research in Morocco, where he spent time with Berber tribal groups. Returning to the United States, he worked with tribal groups in Montana and North Dakota on a Rose Architectural Fellowship, and experimented with building homes for them from straw bales, compressed sunflower seeds and other local materials.

He also taught at Montana State University, where he met Cameron Sinclair and Kate Stohr, the co-founders of AfH. "They were taking a year out in the mountains to write a book, and bumped into me when they were recruiting students as volunteers," he recalled. "When they set up AfH's office in the Bay Area, I was finished with my fellowship, so I went with them."

While they expanded AfH's volunteer network, which now includes 40,000 architects, designers and engineers, and raised funding for its projects, Mr. Corum developed the education program and continued his experiments with sustainable housing by working with Navajo elders in New Mexico and Arizona.

He also participated in AfH design projects, including the work on the Plastiki cabin. "David came to the office to see Cameron in early 2008," he recalled, referring to David de Rothschild, the expedition leader. "I'd been doing a rafting trip, a floating classroom in the Grand Canyon, so we had this boat thing to talk about. We went out for a curry and hatched this idea that AfH could work on a shelter and communications hub to sit on the catamaran, which would be a useful model for our other projects."

This time last year, Mr. Corum was in Arizona working on the Navajo homes. By early fall, much of his time was taken up by the Plastiki, for which he was cabin architect and sustainability consultant. The cabin design was finessed throughout the construction process as the Plastiki team learned more about how the specially developed form of srPET, the plastic used in water bottles, would respond to the voyage. "We also relocated the portholes and ventilators to give good ambient light throughout the cabin, but so the crew would take naps in daytime after crazy 20 hour shifts," he said. "And my friend, Paul Giacomantonio, put a very sophisticated vegetable garden on board."

By mid-December, the Plastiki was completed, and Mr. Corum joined one of its first voyages in San Francisco Bay. Much of the winter and spring was spent running student workshops in the United States, Australia and New Zealand for the Pacific Rim Studio, an AfH program linked to the Plastiki. He'd planned to join the boat in Hawaii after a workshop there in May, but it was blown south and stopped at Easter Island instead, so he returned to San Francisco.

Since then, he has worked on more Navajo homes in Arizona and New Mexico, and a new series of student workshops on indigenous architecture, which will succeed the Pacific Rim Studio. As part of AfH's reconstruction program in Haiti, he is also collaborating with scientists and engineers on developing environmentally responsible ways of recycling concrete to use there.

"Up until this point, I've been a little bit religious about using natural materials, but figuring out how to use plastic for the Plastiki got me thinking about being less picky and working with whatever's available," he said. "It's a question of looking at what's piling up around you, in the ocean it's plastic, and in Haiti it's concrete. We're discussing options now, but when the right eco-concrete build project comes along in Haiti, I'd be keen to get down there."

http://www.nytimes.com/2010/08/02/arts/design/02iht-design2.html?ref=design

Transparency Is Only the Beginning

By FRED A. BERNSTEIN

IN his office in TriBeCa, James Carpenter is surrounded by sheets of glass — thick and thin, wavy and flat, transparent and opaque. Many are samples for his latest projects, which range from the newly renovated and reopened Israel Museum in Jerusalem to a 10-story office building planned for a prominent site in the Manhattan meatpacking district.

Given the hype surrounding some of the new architecture in that neighborhood, "New Yorkers may be burnt out on glass buildings," Mr. Carpenter said. And yet he promises this one will be different, in part because his approach, honed over more than 30 years as a glass artist, involves using the material not as mere enclosure, but as a tool for manipulating light.

While "orthodox" modernists have long thought of glass as a means of making their buildings transparent, Mr. Carpenter said that for him transparency is far down on his list of concerns. What interests him, he explained, is "what is occurring on or in or through the material itself."

In the case of the office building, which is scheduled to begin construction this year on a lot along the High Line, he talks of "privatizing" some light for the interior while returning the rest to the public, altered by its journey through high-tech sandwiches of glass. It's an approach demonstrated in 7 World Trade Center, the Lower Manhattan building known for its unusually lucid facades.

There, blue metal sills reflect light onto and through the backs of clear-glass panes suspended several inches outside the building's enclosure, producing an effect that Mr. Carpenter describes as "volumetric light." (Mr. Carpenter worked on the building with its architect, David Childs, and "had a major impact on the design," said its developer, Larry Silverstein, who has since hired Mr. Carpenter to help create a glowing wall for a pair of residential towers on West 42nd Street.)

But it was not until recently that Mr. Carpenter, now 61, began designing buildings of his own, drawing not just on his years as an artist but also on knowledge he gained in working with architects like Moshe Safdie, Richard Meier and Norman Foster. The sweeping renovation of Israel's national museum, which reopened on Monday after nearly a decade of planning and construction, is his largest project to date. Though not a licensed architect himself — he has several on staff and works with local architects when necessary — he masterminded much of the $100 million transformation of the museum's sprawling campus.

The Israel Museum opened in 1965 in a series of masonry buildings by the Russian-born Israeli architect Alfred Mansfield and a pavilion by the Austrian-American Frederick Kiesler (with Armand P. Bartos) that looks like the lid of a ceramic jar and houses the Dead Sea Scrolls. The architecture of the complex is highly regarded, even sacrosanct, but the buildings were physically separated, without the air-conditioned passageways and other amenities that visitors now expect. Mr. Carpenter's charge was to update the campus without defacing it.

His relative lack of experience proved an advantage. In winning the job, it helped that Mr. Carpenter would not "simply bring a pre-existing signature to our campus," said James Snyder, who became director of the Israel Museum in the 1990s after 22 years at the Museum of Modern Art. Mr. Snyder learned about Mr. Carpenter from a newspaper article about the Fulton Street Transit Center, now under construction in Lower Manhattan, for which Mr. Carpenter helped design a dome that will reflect daylight into underground passageways. Mr. Snyder said he thought a similar approach might work at the museum, where enclosed passageways would be needed to link the buildings.

Those passageways — one illuminated by natural light refracted through a cast glass water feature — now connect the museum's original buildings as well as five new pavilions by Mr. Carpenter, who had to find a way to expose them, and the art within them, to natural light in a part of the world where the sun's rays can be punishing. Mansfield's solution to that problem was to give his stone boxes narrow clerestory windows.

Mr. Carpenter, naturally, made his boxes from glass — but surrounded them with walls of ceramic louvers, each designed to bounce light onto the angled interior surface of the one above. That means reflections of the surrounding sculpture garden, designed by Isamu Noguchi, are seen from inside the glass boxes — a neat trick given that no light enters the buildings directly.

Mr. Carpenter, who was born in Washington and raised in New England, planned to study architecture at the Rhode Island School of Design, where he enrolled in 1968. But he was drawn to the sculpture studio, and particularly to the glass artist Dale Chihuly, who was then teaching at the school. From 1969 to 1974 the two men collaborated on a series of sculptures, including some with neon lights inside, that bear little resemblance to the wild and colorful blown-glass works for which Mr. Chihuly later became famous.

Mr. Carpenter also created more ephemeral pieces using film; in one instance, images of homing pigeons were projected onto a cage full of pigeons. The idea, he said, "was to record a natural phenomenon, then display it in a way that allows you to manipulate it in time and space" — a version of what he now does with light on the surfaces of buildings.

After graduating with a degree in sculpture in 1972, he taught at the Rhode Island School of Design and spent a decade as a consultant to Corning Glass. He also continued making sculptures, which in the 1980s brought him to the attention of the architect Edward Larrabee Barnes. Mr. Barnes was looking for a large-scale artwork for the plaza of his IBM building, then going up at 57th Street and Madison Avenue.

Toshiko Mori, an architect at the Barnes office, interviewed Mr. Carpenter. Though he didn't get the job, he ended up marrying Ms. Mori, now a Harvard architecture professor known for her careful additions to buildings by Paul Rudolph and other 20th-century masters.

Mr. Carpenter has worked with Ms. Mori on several projects, including a visitors center for Frank Lloyd Wright's Darwin D. Martin House in Buffalo. But his most frequent architect-patron has been Mr. Childs, with whom he first worked on an Amtrak station in the early 1980s. In the '90s Mr. Childs brought him in to design a key component of the Time Warner Center at Columbus Circle: the wall of clear glass panes, suspended from cables, that hangs at the center of the building's base.

And then came 7 World Trade, where, in addition to working on the building's facades, he collaborated with the artist Jenny Holzer on an installation that dominates the lobby. Ms. Holzer's text is seen floating through translucent glass panels that disguise a fortified wall.

Though he plans to continue working as a consultant to architects, Mr. Carpenter said, he is also doing more and more projects on his own. (In 2004 he won a MacArthur "genius" grant; the $500,000 award he said, has allowed him to try out ideas even when there were no clients to finance them.)

Perhaps the most dramatic of his planned projects will be an addition to the Bornholm Art Museum in Denmark, housed in a 20-year-old building on an island near the coast of Sweden. "For over 200 years," Mr. Carpenter said, "artists have been attracted to the qualities of light specific to this island." His building will not only house artworks inspired by that light but — if his plans succeed — also become one.

http://www.nytimes.com/2010/08/01/arts/design/01carpenter.html?ref=design

My Life in Therapy

By DAPHNE MERKIN

All those years, all that money, all that unrequited love. It began way back when I was a child, an anxiety-riddled 10-year-old who didn't want to go to school in the morning and had difficulty falling asleep at night. Even in a family like mine, where there were many siblings (six in all) and little attention paid to dispositional differences, I stood out as a neurotic specimen. And so I was sent to what would prove to be the first of many psychiatrists in the four and a half decades to follow — indeed, I could be said to be a one-person boon to the therapeutic establishment — and was initiated into the curious and slippery business of self-disclosure. I learned, that is, to construct an ongoing narrative of the self, composed of what the psychoanalyst Robert Stoller calls "microdots" ("the consciously experienced moments selected from the whole and arranged to present a point of view"), one that might have been more or less cohesive than my actual self but that at any rate was supposed to illuminate puzzling behavior and onerous symptoms — *my* behavior and *my* symptoms.

To this day, I'm not sure that I am in possession of substantially greater self-knowledge than someone who has never been inside a therapist's office. What I do know, aside from the fact that the unconscious plays strange tricks and that the past stalks the present in ways we can't begin to imagine, is a certain language, a certain style of thinking that, in its capacity for reframing your life story, becomes — how should I put this? — addictive. *Projection. Repression. Acting out. Defenses. Secondary compensation. Transference.* Even in these quick-fix, medicated times, when people are more likely to look to Wellbutrin and life coaches than to the mystique-surrounded, intangible promise of psychoanalysis, these words speak to me with all the charged

power of poetry, scattering light into opaque depths, interpreting that which lies beneath awareness. Whether they do so rightly or wrongly is almost beside the point.

IT WAS A SNOWY Tuesday afternoon in February, and I was inching along Fifth Avenue in a taxi, my mood as gray as the sky, on my way to a consultation with a therapist in the Village who was recommended to me by Dr. O., another therapist I had seen in consultation, who in turn was referred to me by a friend's therapist. Once again — how many times have I done this? — I was on a quest for a better therapist, a more intuitive therapist, a therapist I could genuinely call my own, a therapist who could make me happy. I liked Dr. O., a man in his 80s who struck me as having a quick grasp of the essential details, the issues that dragged along with me year after year like a ball and chain. He seemed to get to the heart of the matter — had I ever felt loved? Had I ever loved? — with disarming ease. But then, after several visits, during which I envisioned myself finally and conclusively grappling with things, toppling over the impediments that stood in my way and coming out a winner, Dr. O. suddenly announced that he couldn't take on any new patients. He said he had given the prospect of working with me a great deal of thought but in the end didn't think he was prepared to commit himself.

I resisted the impulse to plead on my behalf, which was my impulse around all elusive men, be they shrinks or lovers, and accepted his verdict. (I later found out that he had been very ill and was in the process of bringing his practice to a close.) I wasn't, after all, therapistless; I had been seeing Dr. L. for the past year and a half, an older woman with a practical manner and a radically limited wardrobe (she wore only black and brown pantsuits) that I had begun to view as a symptom of her tunnel vision, so different from my own scattered and unfiltered way of being. Of late, I had been feeling increasingly dissatisfied with the tenor of our sessions; they seemed more like the sort of conversations you would have with a good friend in a coffee shop than the intense, closely-examined, hesitation-filled discourse I had come to expect from the therapeutic encounter. The subject of "transference" (the patient's projection of feelings and situations from the past onto the therapist), which is usually at the heart of psychoanalysis, didn't even come up for discussion, much less any examination of possible signs of "countertransference" (the analyst's emotional reactions to the patient stemming from his or her unconscious needs and conflicts). There was the day she used the word "cute" to describe a complicated, even twisted man I was telling her about, and I found myself wondering about her own personal evolution, how much she really understood about relations between men and women. Who was to say whether she had the kind of varied real-world experience that I might benefit from, one that could yield the sort of rich understanding of social texture that the anthropologist Clifford Geertz referred to as "thick description"?

My dissatisfaction led me to wonder whether it was time for a change — or whether, at long last, it might be time to strike out on my own and weather my internal and external vicissitudes alone, perilous as that prospect might appear to a person who hadn't been without a therapist's support in 40-odd years. On the other hand, I couldn't actually picture myself going without a listening ear, someone who attended to my story along with me several days a week, who was ready and waiting to receive news of my life, undramatic and unimportant in the larger scheme of things as it might be. It was one thing to mock therapy and its practitioners, as I regularly did, or to fume at the expense; it was another thing entirely to walk away from the cushioning it offered. Much as I might disparage it, I was convinced it had helped keep me alive, bounded to the earth; there were also my antidepressants, of course, steadily elevating my dopamine levels and moderating my moods, but without the benefit of talk therapy, I felt unduly fragile, like a tightrope walker absent a net. Which is why, when Dr. O. conveyed his unavailability, I did what any addict does and asked where else I could get my fix. He said he would think about who might be suitable, and about 10 days later I received a short note from him with the name of Dr. D.

This is how I came to seek out the psychiatrist in the Village, who turned out to be a man in what I guessed to be his early 60s, with saucer eyes that were given to an exaggerated registering of emotion like the eyes of a comic-book character. I arrived at his office magisterially late after the endless cab ride, wet from the snow. I felt immediately on edge, furious at myself for not having taken the subway, silently calculating how much money had evaporated along with the first 20 minutes of the session. I always resented the implacability of the therapeutic "hour" (which translated into a mingy 50, or increasingly these days, 45 minutes at most), the way it commenced at some tediously calibrated moment, like 11:10 or 5:25, instead of satisfyingly on the hour or half-hour. Not to mention the way the end of a session was visible from the start, getting ready to wave goodbye to you and your problems just as you were settling in to reflect more fully upon them. Now, having abbreviated the session even before it began, I felt full of righteous if illogical outrage: who mandated all these carefully preserved professional rituals in the first place — the couch with its flimsy little napkin covering the place where you were to lay your head, the de rigueur box of tissues, the chair (for those who preferred to sit up, like me) placed at a careful distance from the therapist's own? What was the point of these rules? Did they serve the patient in any way or were they just a means of securing the analyst enough patients to bring in the money to pay for a weekend house?

Needless to say, I didn't air any of these thoughts and instead went into my skittish, slightly apologetic, pre-emptively self-deprecating patient mode — intent on sounding like someone who was aware of the pathological currents that ran beneath a life that might be viewed as functional, even successful, if looked at from afar. Dr. D. spoke very little, in the manner of a true-blue analyst — the more silent the therapist, it's safe to say, the more likely he is to favor a strict analytic approach — in a voice that was low and grave, with an almost total absence of inflection. I had to suppress the urge to ask him to speak up for fear of offending him. Still, I was struck by the way he managed to convey a spirit of deep thoughtfulness whenever he did utter a few words. "You have trouble negotiating distance, don't you?" he asked, after I wandered into my hyperkinetic version of free association, saying what came to my mind without exercising too much editorial control, babbling on about the chilly caretaker from my childhood who never answered me when I tried to engage her, moving on to my father's obliviousness to my youthful presence even when I was sitting next to him in a car and then to my fear of being overattached to the people in my life that I felt closest to. "It's a problem for you either way," he added. "Isn't it? Too close. Too far. Neither feel entirely comfortable." I wasn't completely sure what he meant, but I answered that I saw his point.

I went to Dr. D. to discuss the metaphysics of therapy rather than the logistics — whether, that is, I should be in therapy at all, and if so, what for and what kind. I talked about past therapists and their different styles of treatment, most of them Freudian-derived to a greater or lesser extent, all of which had turned me off in one way or another. In therapy that was more psychoanalytically oriented, I told him, I tended to get trapped in long-ago traumas, identifying with myself as a terrified little girl at the mercy of cruel adult forces. This imaginative position would eventually destabilize me, kicking off feelings of rage and despair that would in turn spiral down into a debilitating depression, in which I couldn't seem to retrieve the pieces of my contemporary life. I don't know whether this was because of the therapist's lack of skill, some essential flaw in the psychoanalytic method or some irreparable injury done to me long ago, but the last time I engaged in this style of therapy for an extended period of time with an analyst who kept coaxing me to dredge up more and more painful, ever earlier memories, I ended up in a hospital. When I got out two summers ago, I reacted to the trauma of hospitalization by seeking out the aforementioned Dr. L., who took a more contained, present-oriented approach, with far less time and energy spent trying to excavate distant hurts and grievances. While she may have had the convictions of a Freudian, she also had the manner of a strategic adviser, cheering me on in my daily life. And yet, after seeing her for 18 months, I felt that I was doing myself an injustice by merely skimming the surface, leaving myself vulnerable to the kind of massive subterranean conflict I feared would sooner or later come out of nowhere and hit me hard once again. Would I ever, I wondered, manage to find the right mix, the style of therapy that fit my particular mold? Did it even exist?

As I mulled it over for Dr. D., I noticed that I was speaking with greater detachment and less gusto than I usually brought to the occasion. Perhaps this was a response to Dr. D.'s own removed demeanor, which made me in turn wonder if patients eventually began to sound like their therapists, much in the way husbands and wives of long standing are said to resemble each other. And then there was my feeling that I better not get in too deep. I was wary by this point of the alacrity with which I attached to shrinks, each and every one of them, as if I suspended my usual vigilant powers of critical judgment in their presence merely because they wore the badge of their profession. The truth of the matter was that in more than 40 years of therapy (the only person I knew who may have been at it longer than me was Woody Allen, who once offered me his own analyst), I never developed a set of criteria by which to assess the skill of a given therapist, the way you would assess a dentist or a plumber. Other than a presentable degree of intelligence and an office that didn't set off aesthetic alarms — I tended to prefer genteelly shabby interiors to overly well-appointed ones, although I was wary of therapists who exhibited a Collyer Brothers-like inability to throw anything away — I wasn't sure what made for a good one. I never felt entitled to look at them as members of a service profession, which is what, underneath all the crisscrossing of need and wishfulness, they essentially were. The sense of urgency that generally took me into a new shrink's office was more conducive to seeing myself as the one being evaluated rather than the evaluator. Was I a good-enough patient? Would this latest psychiatrist (I saw mostly M.D.'s) like me and want to take me on? Or would he/she write me off as impossibly disturbed under my cloak of normalcy?

I knew I wasn't the most promising candidate — I was, in fact, a prime example of what is referred to within the profession as a "difficult" patient, what with my clamorous ways, disregard for boundaries and serial treatments — but perhaps this time, after so many disappointments, I would get lucky. Somewhere out there, sitting in a smaller or larger office on Central Park West or the Upper East Side, tucked behind a waiting area furnished with a suitably arty poster or two, a couple of chairs and old copies of The New Yorker and National Geographic Traveler, was a practitioner who would not only understand my lifelong sorrow and anger in an empathic (but not unduly soppy) fashion but also be able to relieve me of them. Just as some people believe in the idea of soul mates, I held fast to the conviction that my perfect therapeutic match was out there. If only I looked hard enough I would find this person, and then the demons that haunted me — my love/hate relationship with my difficult mother (who has been dead now for four years), my self-torturing and intransigently avoidant attitude toward my work, my abiding sense of aloneness and seeming inability to sustain a romantic relationship and, above all, my lapses into severe depression — would become, with my therapist's help, easier to manage.

Therapy, as Freud himself made clear, is never about finding a cure for what ails you. Its aim, despite the lyrical moniker it is known by ("the talking cure" was not actually Freud's phrase but rather that of Dr. Josef Breuer's patient Bertha Pappenheim, whom Freud wrote about as Anna O.), was always more modest. Freud described it as an effort to convert "hysterical misery" into "common unhappiness," which suggests a rather minimalist framework against which to judge progress. There is no absolute goal, no lifetime guarantee, no telling how much therapy is enough therapy, no foolproof way of knowing when you've gotten everything out of it that you can and would be better off spending your valuable time and hard-earned money on other pursuits.

All of which raises the question: What exactly is the point? How can you be expected to know when being in therapy is the right choice, to know which treatments are actually helpful and which serve merely to give the false sense of reassurance that comes with being proactive, with doing all that we can? Does anyone, for example, really know what "character change" looks like? That, after all, is what contemporary therapy that is more than chitchat for the so-called worried well aims to promote. More pressing, who can be trusted to answer these questions? Looked at a certain way, the entire enterprise seems geared toward the needs of the therapist rather than the patient to a degree that can feel, after a certain amount of time, undemocratic, if not

outright exploitative. With no endpoint in sight, it's possible to stay in therapy forever without much real progress; at the same time, the weight of responsibility is borne almost entirely by the patient, whose "resistance" or lack of effort-making is often blamed for any stagnancy in treatment before the possibility of a therapist's shortcomings is even acknowledged. As the psychiatrist Robert Michels observed in his aptly titled essay "Psychoanalysis and Its Discontents," for patients, "it often seems as if psychoanalysis isn't even designed to help them. Patients want answers, whereas psychoanalysts ask questions. Patients want advice, but psychoanalysts are trained not to give advice. Patients want support and love. Psychoanalysts offer interpretations and insight. Patients want to feel better; analysts talk about character change."

My abiding faith in the possibility of self-transformation propelled me from one therapist to the next, ever on the lookout for something that seemed tormentingly out of reach, some scenario that would allow me to live more comfortably in my own skin. For all my doubts about specific tenets and individual psychoanalysts, I believed in the surpassing value of insight and the curative potential of treatment — and that may have been the problem to begin with. I failed to grasp that there was no magic to be had, that a therapist's insights weren't worth anything unless you made them your own and that nothing that had happened to me already could be undone, no matter how many times I went over it.

And yet it seems to me that the process itself, in its very commitment to interiority — its attempt to ferret out prime causes and pivotal events from the psychic rubble of the past and the unwieldy conflicts of the present — can be intriguing enough to stand in as its own reward. In the course of growing up, we all learn to repress our unruly fantasies and to keep our more anarchic thoughts mostly to ourselves. As for our dreams and what they might signify — their "latent content," that is, as opposed to their "manifest content" — who can be expected to be interested in them except a close friend or tolerant spouse, both of whom are assuredly only half listening? Therapy offers us a particular kind of chaste intimacy, one that in its ideal (if not always actual) form is free of the burden of desirous expectations. Or as Adam Phillips, the writer and psychoanalyst, puts it with characteristic brio: "Psychoanalysis is about what two people can say to each other if they agree not to have sex." It is a place to say out loud all that we have grown accustomed to keeping silent, in the hope that we might better understand ourselves and our missteps, come to terms with disowned desires and perhaps even find a more direct route to an effectively examined life. It provides an opportunity unlike any other to sort through the contents of your own mind — an often painfully circuitous operation — in the presence of someone who is trained to make order out of mental chaos. Although it is possible to view the whole exercise as an expensive self-indulgence — or, as its many detractors insist in one way or another, as the disease for which it purports to be the cure — psychoanalysis is the only game in town in which you are free to look and sound your worst the better to live up to your full potential.

FREUDIAN PSYCHOANALYSIS reached its high-water mark in the 1950s, having become something of a secular religion; it offered, as Dan Wakefield observes in his book "New York in the Fifties," a "dream of wholeness" — and, no less important, "the cure for what ailed you sexually." All of the so-called New York Intellectuals, like Delmore Schwartz and Mary McCarthy, dipped into analytic treatment at one time or another; and James Baldwin, in a 1959 essay, noted of "the citizens of this time and place" that "when they talk, they talk to the psychiatrist; on the theory, presumably, that the truth about them is ultimately unspeakable." In the mid-60s, psychoanalysis was still very much in vogue, having not yet become the reviled and increasingly discredited discipline it came to be in the 1980s and 1990s, when anti-Freudians like Frederick Crews and Peter Swales did their dismantling work and the psychopharmaceutical industry flourished. (My favorite line from Donald Barthelme's 1972 short story "The Sandman" is, to my mind, more predictive than descriptive: "The prestige of analysis," the protagonist writes to his girlfriend's shrink, in defense of her decision to give up analysis and use the money saved to buy a grand piano, "is now at a nadir.") Popular magazines like Redbook and McCall's familiarized Middle America with basic Freudian concepts, the better to understand phenomena like marital discord and sibling rivalry, and references to

therapy abounded in theater and film. In their book "Psychiatry and the Cinema," Glen O. Gabbard and Krin Gabbard refer to the period from the late 1950s to the early 1960s as the "Golden Age" of psychiatry in the movies: "For a half-dozen years . . . films reflected — however imperfectly — a growing conviction in American culture that psychiatrists were authoritative voices of reason, adjustment and well-being." In 1969, Alexander Portnoy unburdened the content of his carnal character on the silent Dr. Spielvogel and made his creator, Philip Roth, a household name.

Still, while seeing a shrink was often considered something to be proud of back in the 1960s, lending you an aura of intellectual gravitas, it was at that time largely an adults-only activity. I began seeing my first therapist, Dr. Welsh, at the age of 10, but I didn't know of any other kids my age who availed themselves of a psychiatrist, and the entire venture filled me with shame. I'm not sure how much I told her — children at that age tend to be loyal to their backgrounds, however dysfunctional — but I do recall busily beating up dolls in her office. Welsh was kindly and gray-haired, a renowned child psychiatrist, but to me she was little more than a stranger whose courteous style confused me. For one thing, she wasn't Jewish, which, given my Orthodox upbringing, immediately opened up a chasm of nonfamiliarity between us. For another, I kept wondering why she was so nice to me; I wasn't used to such treatment, which was surely one reason I needed to see a psychiatrist in the first place. I couldn't figure out a connection between the world inside her office and the world outside it; they seemed like separate universes with different rules of conduct. In one, I was listened to, when I did choose to speak, with a great deal of attentiveness; in the other I was more often than not pushed aside, my anxieties discounted or ridiculed.

At some point I stopped seeing Dr. Welsh, and in junior high I started seeing a female psychiatric social worker with a mop of gray curls whose eyes crinkled up when she smiled and whose lack of an advanced degree wasn't lost on me. It was my first inkling that shrinks were just other people in disguise, that they didn't belong to some special class of being. I liked this therapist, who was a warmhearted Jewish woman of a type that I associated with the Eastern European mothers of many of my classmates, but she was no match for my mother's Germanic coldness or her unbreakable grip on me. In any event, I'm not sure how versed she was in the nether reaches of pathological enmeshment, which she would have had to be for us to get anywhere. Short of that, what I wanted was for her to be my mother, just as early on I longed for my male therapists to be my father. Substitute parenting, or "reparenting," as it is referred to, may have been what was on offer in the therapeutic realm, but what I wanted in my overly concrete way was the real thing. I wanted, that is, to be adopted — actually adopted — just as I would later wish for one or the other of my therapists to leave his wife for me. (My model was Elaine May, who married her shrink.)

In my late teens I started seeing Dr. S., a white-haired but vigorous psychiatrist. Like most of the shrinks I would see, he was a deracinated Jew who kept regular hours on Yom Kippur, as if to prove a point. He was an old-school analyst in the American mode, meaning that he hewed to the Freudian party line but in a casual, "we're all only human" sort of fashion, and his office was all the way over on Riverside Drive in the 80s. I remember the address well because in winter, when the wind howled along the side streets in the evenings and I had to make my way to the bus stop at the end of a session, I felt like a character out of "Dr. Zhivago." Although he regularly doodled with his fountain pen on a prescription pad, Dr. S. never took notes, claiming that it was a matter of principle. He sometimes closed his eyes during the session, either to allow himself to relate more profoundly to what I was talking about or to take a quick nap, I was never sure which.

Dr. S.'s office, which was reachable by a spiral staircase from his apartment, was one of the most beautiful — most dignified — I would ever find myself in. It had an air of serene comprehension, of truths having been sought after, suffered through and finally arrived at right within its confines. Spacious and thickly carpeted, with whitewashed walls on which hung a series of sepia-toned prints, it was also filled with the

anthropological artifacts — somber clay heads and stone figures lined his bookshelves — that many psychoanalysts feel obliged to possess in homage to Freud's own cherished collection of tchotchkes. There was a mechanical clock that made a faint whirring sound as it flipped over from one minute to the next, making me acutely aware of stray silences and unspoken thoughts. What made Dr. S.'s setting unique, however, was the constant presence of his dog, a golden-colored beagle with soft, flappy ears. The dog would pad over to my chair when I came in and look at me with her moist sympathetic eyes, waiting to be scratched behind the ears. There were times I refused to oblige her, ignoring her mute appeal until she tucked her tail between her legs and slunk over to Dr. S.'s chair to be petted. I felt, or maybe I was only imagining, the doctor looking at me intently at those moments, taking in my unresponsiveness and making a mental note: *patient inhibited and cold; resists giving affection to loving animals.*

It was with Dr. S. that I began developing a style custom-made to the therapeutic encounter, especially as it played out with male shrinks. Suspicious as I was of men to begin with, based on my experience of a remote father and a passel of brothers who remained alien, sports-obsessed creatures to me, it was hard for me to believe in their interest, much less their kindly intentions. As a result, I would use up a lot of the hour making apposite, witty remarks in an effort to entertain Dr. S. (a shrink I saw a few years back found me so knee-slappingly funny that he asked whether I had ever considered becoming a stand-up comedian) and spent the rest of the time pelting him with accusatory questions as to the quality of his attention and his reasons for seeing me: Was he really listening to me? Or was he preoccupied with his dog, especially after she had been injured in a car accident on Riverside Drive? Did he ever think about me when I wasn't sitting in front of him? Would he see me if I couldn't afford to pay his fee? If he was only doing this for the money, I blithely continued, why hadn't he gone into a more remunerative profession, like law or business? Why the veneer of caring?

Despite my repeated threats to leave, I continued to see Dr. S. through my college years. When I look back on it, it seems to me that he was a gem of a man, really, to put up with my hot-and-cold attitude toward the work he was trying to do with me, but it did me little good at the time. Part of the problem was that Dr. S. tended to speak in broad generalities, which I found anything but reassuring. When I would say, for instance, as I often did, that nobody cared about me (by which I mainly meant my parents), he would answer, "First you must care about yourself." This struck me as a sleight-of-hand solution, one that only fueled my anxiety that this feeling of universal indifference was not a neurotic misperception but the truth, the horrible truth lying in wait for me to come upon it. Could it be that the essence of my treatment consisted of Dr. S.'s gently leading me up to the dismal reality that was my life — that I would be "cured" only when I faced up to my darkest fears and accepted them as legitimate rather than exaggerated?

The goal of successful psychoanalysis, I knew, especially when it came to more severe problems, was not just to modify neurotic suffering so it took on the aspect of "ordinary unhappiness," but to effect a real difference in the patient's way of functioning. My character, sadly enough, seemed the same as it had always been, given to angry outbursts that alienated the very people I wanted around me, followed by regretful nostalgia for that which might have been. I had succeeded in driving away my first serious boyfriend, a bearded medical student, with precisely such maneuverings. And all Dr. S. managed to come up with in response to my acute grief over Mark was the suggestion that I think of him as dead. When I came in with what I saw as a telltale dream, in which I walked up and down the hallway outside Mark's apartment until he opened the door and saw me, thereby vindicating me in my wistful belief that he hadn't forgotten me, that the force between us was so strong that it could lead him to intuit that I was outside his apartment door, Dr. S. insisted on pointing out the flaws in my reasoning: "You realize, don't you, that in your dream Mark only opened the door because he heard a disturbance outside. You were walking back and forth and making noise, so naturally he wanted to find out what was going on. It had nothing to do with the feelings he once had for you. You were intruding. You could have been anyone." I scornfully replied that the hallway was *carpeted*, that I wasn't

making any noise and that Mark just felt me out there. The doctor puffed sagely on his pipe and disagreed with me once again, taking the sort of gentle tone you would use with a hopelessly crazy person.

Dr. S. was fond of telling me that the past didn't interest him "except in terms of the present," which was all fine and well except for the fact that it left me marooned, by myself, in ghostly rooms. I felt more rather than less alone in therapy, stuck with myself and my self-destructive patterns, which I saw as direct products of the very past that Dr. S. didn't care to explore. Weren't analysts supposed to be expert guides through the minefields of the past? Wasn't going back into the interior where early humiliations festered their proclaimed specialty? If not, then whence was this ever-elusive "character change" supposed to emerge? Even to this day, I'm not sure I know anyone whose character has been genuinely transformed because of therapy. If anything, most people seem to emerge as more backed-up versions of themselves.

THESE ARE SOME of the things that never happened in therapy: No one ever stopped me from doing something I was intent on doing, even if it was clear that the issue was a symbolically loaded one and worthy of further exploration before I took any action. No one ever offered to adopt me or to take me home for so much as a single night, like the British child psychiatrist D. W. Winnicott (my ideal shrink) did with one of his patients. No one ever suggested that I move away from home or stand up to my parents. No one ever offered to see me free of charge. No one ever took me on his or her lap, as the Hungarian analyst Sandor Ferenczi was known to have done, in keeping with his belief that the clinical interaction should be a reciprocally empathic, mutual encounter. (Ferenczi and Freud would eventually break over their different therapeutic stances but not before Ferenczi noted in his clinical diary that Freud shared with him the harsh sentiment "that neurotics are a rabble, good only to support us financially and to allow us to learn from their cases: psychoanalysis as a therapy may be worthless.") And for all the emphasis on therapy's being a place of intimate disclosure — for all the times, in between shows of hostility, that I haltingly stated my feelings of great affection or even love for my therapists — none of them ever opened up about their feelings for me other than to convey a vague liking or appreciation for some facet of my personality.

Here are some of the things that did happen in therapy: My mother once came to a session with a hipster shrink and his trippy wife-partner whom I saw briefly in my late 20s, and their opening move was to ask about the state of *her* sex life. She inquired stonily what this had to do with helping me, while I squirmed in my seat, wondering what I was doing with this harebrained pair. Some years later, when I was in my mid-30s, my mother came to another session, this time with Dr. E., a young and pretty psychiatrist whose last name indicated a hefty WASP lineage. During this session the three of us decided that I would marry the man I had been dating on and off for the past six years, despite the fact that I had broken off my engagement to him months earlier. We discussed the matter of my newly pending marriage as if it were simply the practical solution to a neurotic issue, having little to do with the man in question and much to do with my abiding inability to make a decision. I remember distinctly that Dr. E. and my mother agreed that I was a very loyal person and that the chances of my getting divorced, no matter how tentative I might have felt about going ahead, were minuscule. (As it turned out, I divorced less than five years later.) They also agreed that I should proceed rapidly so that I would have less time to mull things over: my nuptials were accordingly scheduled for three weeks from the day of our meeting. Needless to say, everything was hastily arranged, from the invitations to the flowers, and the whole affair had the quality of a shotgun wedding, albeit one whose urgency came not from an incipient baby but from the fear of my thoroughgoing ambivalence that was shared by my mother and my shrink. Dr. E. came to the ceremony, looking lovely and blond in a black velvet dress, but she left before the dinner, as if to draw a line between being a witness to the event and being a friend. She has gone on to achieve spectacular success in her career, and to this day I wonder whether she thinks of her intervention as courageous or a mistake of her youth.

Two of my therapists died on me, one quite suddenly only months after I started seeing her and the other after suffering a recurrence of leukemia during my treatment with him. A third committed suicide, jumping off the roof of the very building where I had gone to see him. He had struck me as slightly forlorn, verging on seedy, when I was his patient, like a character out of a W. Somerset Maugham novel. He moved his jaw a lot when he spoke, and I thought I heard his teeth click, suggesting ill-fitting dentures. After I arrived uncharacteristically early one day and overheard him asking out a woman on a date on his living-room phone, I decided I could not live with his desolation — my own was hard enough — and brought my visits to an end. He killed himself about a year later, and although I was not egotistical enough to imagine that his dire act had anything to do with me, I felt guilty all the same for having rejected him.

The analyst who died shortly after I began going to her was an energetic European of about 70. She went into the hospital for what was supposed to have been a routine matter and never came out. Even though this happened nearly three decades ago, to this day I think of Dr. Edrita Fried as the one who got away — the one who might have worked miracles, because she reminded me of a more benign version of my mother and thus would be uniquely capable of understanding the kind of damage that had been done. She was also, up to that point, the only therapist I chose on my own, without benefit of one of the two consultants my parents turned to for referrals. I discovered Dr. Fried by chance, stumbling across a book she wrote on the shelf of a local bookstore. It was called "The Courage to Change," and I read it cover to cover almost on the spot; when I finished, I called her blind and, much to my surprise, she readily agreed to see me. (I thought of analysts as existing in a closed circle to which you could gain access only by mentioning the name of a colleague they approved of.) Although I must have seen Dr. Fried for just a month or two before she was hospitalized, I had already formed a strong attachment to her when I received the call that she died. I remember sitting on my bed in my dark little apartment on 79th Street, holding the phone in my hand even after the person on the other end hung up, feeling doomed.

Nothing, however, compared with the overwhelming loss I felt at the death of Dr. A., whom I saw in my mid-20s and whose re-emerged cancer I failed to pick up on even after he started to display the telltale signs of radiation treatment: skin that was reddened and raw and a toupee that covered up his thinning hair, which I didn't at the time recognize as a toupee at all but thought of as a strange new Prince Valiant-like hairstyle he just happened to be trying out. I even questioned him about it. *How did you suddenly sprout bangs? You've always parted your hair to the side before.* That made me cringe later on when I realized the truth of the matter. Even if I could forgive myself for misreading the physical clues, I should have known something was up when he suddenly announced that he was taking an impromptu vacation during the following spring instead of waiting for the proverbial shrinkless August. (The majority of therapists take August off, as if it were a religious obligation, leaving their patients to stew in their own juices.) He was suspiciously specific about the details, almost as if he were trying to avoid any probing questions by giving me more information than I could ever need up front. First, he told me, he was planning to visit a sick uncle, then to join his family on one of their athletic trips — the kind that featured canoes and tents instead of hotel rooms — across some carefully selected part of the American wilderness. I should have smelled a rat right there and then, but the truth was that I had never been informed of Dr. A.'s illness in the first place and probably would have disavowed the evidence of its return even if I had, so focused was I on my life with him inside his office.

The trouble, you see, was that I loved Dr. A., even though this often took the form of my fighting with him. Because he happened to have a small red rug under his chair, for instance, I saw fit to tell him that red was my least favorite color. In the same vein, after I began to suspect that the carefully framed photos of mountains and forest scenes that hung on his walls were in fact taken by him — I could just imagine him trudging up a perilously narrow footpath with an up-to-the-minute camera slung across his chest — I made sure to tell him that I found them numbingly bland. In some way, I'm sure, I was trying to catch him out and prove him unworthy of my attachment, but for the most part these fights were just a ruse, a way of throwing him off the

scent. Dr. A., whom I took to be in his 40s, was the only person in my life who paid close attention to my innermost being: I felt fully recognized by him, felt that he saw me as I was and that I could thus trust him with the bad as well as the good about myself. Who else besides a therapist, when it comes down to it, can you trust to accept all parts of you? Your parents, if you are lucky. So I loved Dr. A. and relied on him and fought with him, fought about the money I had to pay him, fought about the rug and the photos and his skin and his hairstyle until it was too late to straighten anything out.

Talk about a lack of proper "termination" of the psychoanalytic experience. That last week before he left, we scheduled an extra session. I felt worried about his departure, despite his elaborate explanations, and wondered out loud if Dr. A. was trying to punish me in some way for being so contentious a patient. "Of course not," he said, laughing. "I like our fights, at least most of the time. No, I'm afraid you're stuck with me."

But, as it turned out, I hadn't been stuck with him, nor he with me. A day before he was due back I received a phone call from a woman with a curt voice who introduced herself as a colleague of Dr. A.'s and told me that he wouldn't be returning from his "vacation," a vacation he had obviously invented to cover a hideous final absence. No niceties, no anything. When I asked what was wrong, the woman became evasive and suggested I come in to talk. I made an appointment for the next day, which wasn't soon enough, so filled was I with panic. The woman proved to be a psychiatrist herself, with the diplomas and seating arrangement to prove it, and she seemed intent on keeping Dr. A.'s whereabouts a secret. It was the most hideous of possible scenarios, Kafkaesque really: I found myself sitting in a strange doctor's office asking the same questions over and over again, as though persistence would yield up answers. No, he wasn't dead, it seemed, but he was sick, too sick to plan on seeing me again even if he did get well. What about his other patients, I wanted to know. And what was wrong with him exactly? Nothing, it appeared, could be divulged. All I was entitled to know was that Dr. A. wouldn't be coming back and that it was important I find myself another doctor. "I can give you names," she told me. "There are other good people who can help you." Names! I didn't want names. "I want Dr. A. back," I said and started to cry.

I went home and wrote Dr. A. a long letter as he lay dying, for that clearly was what he was doing. In it I expressed all the gratitude and love I had failed — not wanted — to tell him about while he was irritatingly alive. I wrote him: "I am so sad my tears could fill your swimming pool." I was alluding to a longstanding joke between us, about his needing the money I so reluctantly paid him so he could regrout the bottom of his pool. I started paying attention to the death notices, and I came upon what I was dreading one morning in early May. It was a couple of lines, rather anonymous sounding if you weren't familiar with the subject. Dr. A. was dead, his last bill to me still unpaid.

This past April, while I was trying to decide on whether to stay with Dr. L., in spite of her failings, or to embark on a new treatment or to take a break from therapy altogether, I went for yet another consultation. Dr. F. was famous for his tough way with patients and his theoretical contributions to the field. Although he was short and slight, there was a palpable aura of power around him, a sense that here was a man who was used to whipping patients into shape. He spent three sessions on an intake of my history, jotting down notes. I listened to my self-accounting with a tired and critical ear, wondering why I was still so out to sea, still so mired in conflict. I had decided to spare Dr. F. none of my myriad doubts, fears, fantasies and unfulfilled wishes, even though articulating some of them made me inwardly wince. I wondered whether I had become too used to seeing myself through a pathological prism, one that didn't leave room for small pleasures — for the fleeting nature of satisfaction. If there were many things I wished I had done, there were also things I was proud of, but there seemed to be no room for them here, in this cloistered space devoted to unearthing the clouds behind the silver linings. Happiness, as we all know, can't be pursued directly, but what was the gain in tracking

down every nuance of unhappiness, meticulously uncovering origins that left a lot to be desired but that could never be changed, no matter how skillfully you tried to reconstruct them?

Dr. F. and I made a fourth appointment for him to give me his impressions as well as his suggestions on what I should do next. Knowing his reputation for being confrontational with his patients, I braced myself for the worst. Even so, I wasn't prepared for his ruthlessly pragmatic line of thinking, which had less to do with any inner torment I alluded to and more to do with the face I presented to the world, as if I were applying for a position as a flight attendant or a sales rep. He wondered, for instance, whether I thought of losing weight. Dumbstruck, I momentarily lost my footing, and then I answered that I had. He nodded and then coldly observed, "But you lack the motivation." No, I said, I didn't lack the motivation forever, I just lacked it for right now. Dr. F. looked entirely unconvinced and went on to ask me if I didn't long to be part of a couple, to have someone to visit art galleries with. I said I did but that it hadn't worked out thus far. "You are alone," he repeated, as if I were in a state of denial. "I know," I answered. "Many women are alone." He then noted that I hadn't written as much as I might have, that I procrastinated and was often late on coming through with assignments. His tone was smug and self-congratulatory, as if he had adduced these aspects of my character on his own when in reality he was simply throwing back at me the bits of incriminating information that I had willingly offered up. I found myself growing ever more defensive, ready to rise up and fight for the rights of unsvelte, unattached and underachieving women everywhere. Who was he to cast me in his patriarchal, bourgeois mold? Sure, I could lose some weight, but how had this come to be the main diagnostic issue? And I wasn't completely alone: I had a daughter, I had friends, I had had my share of passion, ex-boyfriends and an ex-husband, there were more things in heaven and earth than were dreamed of in Dr. F.'s philosophy.

Dr. F. concluded with the recommendation that I see him or someone like him, who was trained in his methodology, which involved focusing on the transference between patient and analyst. I thanked him for his time and, a bit dazed from the encounter, went off to get a cup of coffee and think things over. At one point in my life I would have been thrilled to be offered the chance to see Dr. F. in all his brutal confidence, hoping that he could rearrange the shape of my character where no one had succeeded before. Now, however, in my 50s, I only felt persuaded that the last thing I wanted was to put myself into Dr. F.'s hands. I realized that I had been carrying a "Wizard of Oz"-like fantasy with me all these years, hoping to find someone who would not turn out to be just another little man behind a velvet curtain. It was not that I found all my shrinks to be impostors, exactly, but it dawned on me that I no longer had the requisite belief in the process — perhaps had never had it in sufficient quantity. After 40-odd years of trying to find my perfect therapist, I didn't want to explore my transferential relationship with Dr. F. or anyone. I didn't want to pay high fees for 45 minutes of conversation with someone sitting opposite me whom I knew little about but who knew shameful facts about me. I didn't want another one-way attachment, which would come to an end when I stopped paying for it. My skeptical 20-year-old daughter once referred to therapy as "emotional prostitution," and although I thought the term a bit reductive, there was a piece of unpleasant truth to it.

I WENT BACK a week later to Dr. L., the woman I had been seeing for the past year and a half, and told her I wanted to stop therapy — for a while or for good, I wasn't sure. To her credit, she didn't try to persuade me that I was making a terrible mistake or suggest that we needed to discuss my wish to leave for the next 20 sessions. She simply let me go, with warm assurances that I could return whenever I felt the urge to. I left her office feeling liberated and scared at the same time. I started walking down the block, placing my feet deliberately one after the other, as if to confirm the reality of my un-propped-up existence. The world, it was good to see, was still standing, even as I detached myself from the ur-figure of the therapist.

All those years, I thought, all that money, all that unrequited love. Where had the experience taken me and was it worth the long, expensive ride? I couldn't help wondering whether it kept me too cocooned in the past

to the detriment of the present, too fixated on an unhappy childhood to make use of the opportunities of adulthood. Still, I recognized that therapy served me well in some ways, providing me with a habit of mind that enabled me to look at myself with a third eye and take some distance on my own repetitive patterns and compulsions. In the offices of countless therapists — some gifted, some less so — I sharpened my perceptions about myself and came to a deeper understanding of the persistent claim of early, unmet desires in all of us.

Therapy, you might say, became a kind of release valve for my life; it gave me a place to say the things I could say nowhere else, express the feelings that would be laughed at or frowned upon in the outside world — and in so doing helped to alleviate the insistent pressure of my darker thoughts. It buffered me as well as prodded me forward; above all, it provided a space for interior examination, an education in disillusioned realism that existed nowhere else on this cacophonous, frantic planet. If after many years of an almost-addictive attachment, I decided it was time to come up for air, I also knew it is in the nature of addicts never to be cured, but always to be in recovery. Good as it felt to strike out on my own, I was sure that one day in the not too distant future I would be making my way to a new therapist's office, ready to pick up the story where I left off.

Daphne Merkin is a contributing writer. She is working on a book based on an article she wrote for the magazine about her struggle with chronic depression.

http://www.nytimes.com/2010/08/08/magazine/08Psychoanalysis-t.html?ref=magazine

But Will It Make You Happy?

By STEPHANIE ROSENBLOOM

SHE had so much.

A two-bedroom apartment. Two cars. Enough wedding china to serve two dozen people.

Yet Tammy Strobel wasn't happy. Working as a project manager with an investment management firm in Davis, Calif., and making about $40,000 a year, she was, as she put it, caught in the "work-spend treadmill."

So one day she stepped off.

Inspired by books and blog entries about living simply, Ms. Strobel and her husband, Logan Smith, both 31, began donating some of their belongings to charity. As the months passed, out went stacks of sweaters, shoes,

books, pots and pans, even the television after a trial separation during which it was relegated to a closet. Eventually, they got rid of their cars, too. Emboldened by a Web site that challenges consumers to live with just 100 personal items, Ms. Strobel winnowed down her wardrobe and toiletries to precisely that number.

Her mother called her crazy.

Today, three years after Ms. Strobel and Mr. Smith began downsizing, they live in Portland, Ore., in a spare, 400-square-foot studio with a nice-sized kitchen. Mr. Smith is completing a doctorate in physiology; Ms. Strobel happily works from home as a Web designer and freelance writer. She owns four plates, three pairs of shoes and two pots. With Mr. Smith in his final weeks of school, Ms. Strobel's income of about $24,000 a year covers their bills. They are still car-free but have bikes. One other thing they no longer have: $30,000 of debt.

Ms. Strobel's mother is impressed. Now the couple have money to travel and to contribute to the education funds of nieces and nephews. And because their debt is paid off, Ms. Strobel works fewer hours, giving her time to be outdoors, and to volunteer, which she does about four hours a week for a nonprofit outreach program called Living Yoga.

"The idea that you need to go bigger to be happy is false," she says. "I really believe that the acquisition of material goods doesn't bring about happiness."

While Ms. Strobel and her husband overhauled their spending habits before the recession, legions of other consumers have since had to reconsider their own lifestyles, bringing a major shift in the nation's consumption patterns.

"We're moving from a conspicuous consumption — which is 'buy without regard' — to a calculated consumption," says Marshal Cohen, an analyst at the NPD Group, the retailing research and consulting firm.

Amid weak job and housing markets, consumers are saving more and spending less than they have in decades, and industry professionals expect that trend to continue. Consumers saved 6.4 percent of their after-tax income in June, according to a new government report. Before the recession, the rate was 1 to 2 percent for many years. In June, consumer spending and personal incomes were essentially flat compared with May, suggesting that the American economy, as dependent as it is on shoppers opening their wallets and purses, isn't likely to rebound anytime soon.

On the bright side, the practices that consumers have adopted in response to the economic crisis ultimately could — as a raft of new research suggests — make them happier. New studies of consumption and happiness show, for instance, that people are happier when they spend money on experiences instead of material objects, when they relish what they plan to buy long before they buy it, and when they stop trying to outdo the Joneses.

If consumers end up sticking with their newfound spending habits, some tactics that retailers and marketers began deploying during the recession could become lasting business strategies. Among those strategies are proffering merchandise that makes being at home more entertaining and trying to make consumers feel special by giving them access to exclusive events and more personal customer service.

While the current round of stinginess may simply be a response to the economic downturn, some analysts say consumers may also be permanently adjusting their spending based on what they've discovered about what truly makes them happy or fulfilled.

"This actually is a topic that hasn't been researched very much until recently," says Elizabeth W. Dunn, an associate professor in the psychology department at the University of British Columbia, who is at the forefront of research on consumption and happiness. "There's massive literature on income and happiness. It's amazing how little there is on how to spend your money."

CONSPICUOUS consumption has been an object of fascination going back at least as far as 1899, when the economist Thorstein Veblen published "The Theory of the Leisure Class," a book that analyzed, in part, how people spent their money in order to demonstrate their social status.

And it's been a truism for eons that extra cash always makes life a little easier. Studies over the last few decades have shown that money, up to a certain point, makes people happier because it lets them meet basic needs. The latest round of research is, for lack of a better term, all about emotional efficiency: how to reap the most happiness for your dollar.

So just where does happiness reside for consumers? Scholars and researchers haven't determined whether Armani will put a bigger smile on your face than Dolce & Gabbana. But they have found that our types of purchases, their size and frequency, and even the timing of the spending all affect long-term happiness.

One major finding is that spending money for an experience — concert tickets, French lessons, sushi-rolling classes, a hotel room in Monaco — produces longer-lasting satisfaction than spending money on plain old stuff.

" 'It's better to go on a vacation than buy a new couch' is basically the idea," says Professor Dunn, summing up research by two fellow psychologists, Leaf Van Boven and Thomas Gilovich. Her own take on the subject is in a paper she wrote with colleagues at Harvard and the University of Virginia: "If Money Doesn't Make You Happy Then You Probably Aren't Spending It Right." (The Journal of Consumer Psychology plans to publish it in a coming issue.)

Thomas DeLeire, an associate professor of public affairs, population, health and economics at the University of Wisconsin in Madison, recently published research examining nine major categories of consumption. He discovered that the only category to be positively related to happiness was leisure: vacations, entertainment, sports and equipment like golf clubs and fishing poles.

Using data from a study by the National Institute on Aging, Professor DeLeire compared the happiness derived from different levels of spending to the happiness people get from being married. (Studies have shown that marriage increases happiness.)

"A $20,000 increase in spending on leisure was roughly equivalent to the happiness boost one gets from marriage," he said, adding that spending on leisure activities appeared to make people less lonely and increased their interactions with others.

According to retailers and analysts, consumers have gravitated more toward experiences than possessions over the last couple of years, opting to use their extra cash for nights at home with family, watching movies

and playing games — or for "staycations" in the backyard. Many retailing professionals think this is not a fad, but rather "the new normal."

"I think many of these changes are permanent changes," says Jennifer Black, president of the retailing research company Jennifer Black & Associates and a member of the Governor's Council of Economic Advisors in Oregon. "I think people are realizing they don't need what they had. They're more interested in creating memories."

She largely attributes this to baby boomers' continuing concerns about the job market and their ability to send their children to college. While they will still spend, they will spend less, she said, having reset their priorities.

While it is unlikely that most consumers will downsize as much as Ms. Strobel did, many have been, well, happily surprised by the pleasures of living a little more simply. The Boston Consulting Group said in a June report that recession anxiety had prompted a "back-to-basics movement," with things like home and family increasing in importance over the last two years, while things like luxury and status have declined.

"There's been an emotional rebirth connected to acquiring things that's really come out of this recession," says Wendy Liebmann, chief executive of WSL Strategic Retail, a marketing consulting firm that works with manufacturers and retailers. "We hear people talking about the desire not to lose that — that connection, the moment, the family, the experience."

Current research suggests that, unlike consumption of material goods, spending on leisure and services typically strengthens social bonds, which in turn helps amplify happiness. (Academics are already in broad agreement that there is a strong correlation between the quality of people's relationships and their happiness; hence, anything that promotes stronger social bonds has a good chance of making us feel all warm and fuzzy.)

And the creation of complex, sophisticated relationships is a rare thing in the world. As Professor Dunn and her colleagues Daniel T. Gilbert and Timothy D. Wilson point out in their forthcoming paper, only termites, naked mole rats and certain insects like ants and bees construct social networks as complex as those of human beings. In that elite little club, humans are the only ones who shop.

AT the height of the recession in 2008, Wal-Mart Stores realized that consumers were "cocooning" — vacationing in their yards, eating more dinners at home, organizing family game nights. So it responded by grouping items in its stores that would turn any den into an at-home movie theater or transform a backyard into a slice of the Catskills. Wal-Mart wasn't just selling barbecues and board games. It was selling experiences.

"We spend a lot of time listening to our customers," says Amy Lester, a spokeswoman for Wal-Mart, "and know that they have a set amount to spend and need to juggle to meet that amount."

One reason that paying for experiences gives us longer-lasting happiness is that we can reminisce about them, researchers say. That's true for even the most middling of experiences. That trip to Rome during which you waited in endless lines, broke your camera and argued with your spouse will typically be airbrushed with "rosy recollection," says Sonja Lyubomirsky, a psychology professor at the University of California, Riverside.

Professor Lyubomirsky has a grant from the National Institute of Mental Health to conduct research on the possibility of permanently increasing happiness. “Trips aren’t all perfect,” she notes, “but we remember them as perfect.”

Another reason that scholars contend that experiences provide a bigger pop than things is that they can’t be absorbed in one gulp — it takes more time to adapt to them and engage with them than it does to put on a new leather jacket or turn on that shiny flat-screen TV.

“We buy a new house, we get accustomed to it,” says Professor Lyubomirsky, who studies what psychologists call “hedonic adaptation,” a phenomenon in which people quickly become used to changes, great or terrible, in order to maintain a stable level of happiness.

Over time, that means the buzz from a new purchase is pushed toward the emotional norm.

“We stop getting pleasure from it,” she says.

And then, of course, we buy new things.

When Ed Diener, a psychology professor at the University of Illinois and a former president of the International Positive Psychology Association — which promotes the study of what lets people lead fulfilling lives — was house-hunting with his wife, they saw several homes with features they liked.

But unlike couples who choose a house because of its open floor plan, fancy kitchens, great light, or spacious bedrooms, Professor Diener arrived at his decision after considering hedonic-adaptation research.

“One home was close to hiking trails, making going hiking very easy,” he said in an e-mail. “Thinking about the research, I argued that the hiking trails could be a factor contributing to our happiness, and we should worry less about things like how pretty the kitchen floor is or whether the sinks are fancy. We bought the home near the hiking trail and it has been great, and we haven’t tired of this feature because we take a walk four or five days a week.”

Scholars have discovered that one way consumers combat hedonic adaptation is to buy many small pleasures instead of one big one. Instead of a new Jaguar, Professor Lyubomirsky advises, buy a massage once a week, have lots of fresh flowers delivered and make phone calls to friends in Europe. Instead of a two-week long vacation, take a few three-day weekends.

“We do adapt to the little things,” she says, “but because there’s so many, it will take longer.”

BEFORE credit cards and cellphones enabled consumers to have almost anything they wanted at any time, the experience of shopping was richer, says Ms. Liebmann of WSL Strategic Retail. “You saved for it, you anticipated it,” she says.

In other words, waiting for something and working hard to get it made it feel more valuable and more stimulating.

In fact, scholars have found that anticipation increases happiness. Considering buying an iPad? You might want to think about it as long as possible before taking one home. Likewise about a Caribbean escape: you'll get more pleasure if you book a flight in advance than if you book it at the last minute.

Once upon a time, with roots that go back to medieval marketplaces featuring stalls that functioned as stores, shopping offered a way to connect socially, as Ms. Liebmann and others have pointed out. But over the last decade, retailing came to be about one thing: unbridled acquisition, epitomized by big-box stores where the mantra was "stack 'em high and let 'em fly" and online transactions that required no social interaction at all — you didn't even have to leave your home.

The recession, however, may force retailers to become reacquainted with shopping's historical roots.

"I think there's a real opportunity in retail to be able to romance the experience again," says Ms. Liebmann. "Retailers are going to have to work very hard to create that emotional feeling again. And it can't just be 'Here's another thing to buy.' It has to have a real sense of experience to it."

Industry professionals say they have difficulty identifying any retailer that is managing to do this well today, with one notable exception: Apple, which offers an interactive retail experience, including classes.

Marie Driscoll, head of the retailing group at Standard & Poor's, says chains have to adapt to new consumer preferences by offering better service, special events and access to designers. Analysts at the Boston Consulting Group advise that companies offer more affordable indulgences, like video games that provide an at-home workout for far less than the cost of a gym membership.

Mr. Cohen of the NPD Group says some companies are doing this. Best Buy is promoting its Geek Squad, promising shoppers before they buy that complicated electronic thingamajig that its employees will hold their hands through the installation process and beyond.

"Nowadays with the economic climate, customers definitely are going for a quality experience," says Nick DeVita, a home entertainment adviser with the Geek Squad. "If they're going to spend their money, they want to make sure it's for the right thing, the right service."

With competition for consumer dollars fiercer than it's been in decades, retailers have had to make the shopping experience more compelling. Mr. Cohen says automakers are offering 30-day test drives, while some clothing stores are promising free personal shoppers. Malls are providing day care while parents shop. Even on the Web, retailers are connecting on customers on Facebook, Twitter and Foursquare, hoping to win their loyalty by offering discounts and invitations to special events.

FOR the last four years, Roko Belic, a Los Angeles filmmaker, has been traveling the world making a documentary called "Happy." Since beginning work on the film, he has moved to a beach in Malibu from his house in the San Francisco suburbs.

San Francisco was nice, but he couldn't surf there.

"I moved to a trailer park," says Mr. Belic, "which is the first real community that I've lived in in my life." Now he surfs three or four times a week. "It definitely has made me happier," he says. "The things we are

trained to think make us happy, like having a new car every couple of years and buying the latest fashions, don't make us happy."

Mr. Belic says his documentary shows that "the one single trait that's common among every single person who is happy is strong relationships."

Buying luxury goods, conversely, tends to be an endless cycle of one-upmanship, in which the neighbors have a fancy new car and — bingo! — now you want one, too, scholars say. A study published in June in Psychological Science by Ms. Dunn and others found that wealth interfered with people's ability to savor positive emotions and experiences, because having an embarrassment of riches reduced the ability to reap enjoyment from life's smaller everyday pleasures, like eating a chocolate bar.

Alternatively, spending money on an event, like camping or a wine tasting with friends, leaves people less likely to compare their experiences with those of others — and, therefore, happier.

Of course, some fashion lovers beg to differ. For many people, clothes will never be more than utilitarian. But for a certain segment of the population, clothes are an art form, a means of self-expression, a way for families to pass down memories through generations. For them, studies concluding that people eventually stop deriving pleasure from material things don't ring true.

"No way," says Hayley Corwick, who writes the popular fashion blog Madison Avenue Spy. "I could pull out things from my closet that I bought when I was 17 that I still love."

She rejects the idea that happiness has to be an either-or proposition. Some days, you want a trip, she says; other days, you want a Tom Ford handbag.

MS. STROBEL — our heroine who moved into the 400-square foot apartment — is now an advocate of simple living, writing in her spare time about her own life choices at Rowdykittens.com.

"My lifestyle now would not be possible if I still had a huge two-bedroom apartment filled to the gills with stuff, two cars, and 30 grand in debt," she says.

"Give away some of your stuff," she advises. "See how it feels."

http://www.nytimes.com/2010/08/08/business/08consume.html?src=me&ref=general

Phys Ed: Can Exercise Moderate Anger?

By GRETCHEN REYNOLDS

David Sacks/Getty Images

For years, researchers have known that exercise can affect certain moods. Running, bike riding and other exercise programs have repeatedly been found to combat clinical depression. Similarly, a study from Germany published in April found that light-duty activity like walking or gardening made participants "happy," in the estimation of the scientists. Even laboratory rats and mice respond emotionally to exercise; although their precise "moods" are hard to parse, their behavior indicates that exercise makes them more relaxed and confident.

But what about anger, one of the more universal and, in its way, destructive moods? Can exercise influence how angry you become in certain situations?

A study presented at the most recent annual conference of the American College of Sports Medicine provides some provocative if ambiguous answers. For the study, hundreds of undergraduates at the University of Georgia filled out questionnaires about their moods. From that group, researchers chose 16 young men with "high trait anger" or, in less technical terms, a very short fuse. They were, their questionnaires indicated, habitually touchy.

The researchers invited the men to a lab and had them fill out a survey about their moods at that moment. During the two days of the study, the men were each fitted with high-tech hairnets containing multiple sensors that could read electrical activity in the brain. Next, researchers flashed a series of slides across viewing screens set up in front of each young man. The slides, intended to induce anger, depicted upsetting events like Ku Klux Klan rallies and children under fire from soldiers, which were interspersed with more pleasant images. Electrical activity in the men's brains indicated that they were growing angry during the display. For confirmation, they described to researchers how angry they felt, using a numerical scale from 0 to 9.

On alternate days, after viewing the slides again (though always in a different order), the men either sat quietly or rode a stationary bike for 30 minutes at a moderate pace while their brain patterns and verbal estimations of anger were recorded. Afterward, the researchers examined how angry the volunteers became during each session.

The results showed that when the volunteers hadn't exercised, their second viewing of the slides aroused significantly more anger than the first. After exercise, conversely, the men's anger reached a plateau. They still became upset during the slide show — exercise didn't inure them to what they saw — but the exercise allowed them to end the session no angrier than they began it.

What the results of the study suggest is that "exercise, even a single bout of it, can have a robust prophylactic effect" against the buildup of anger, said Nathaniel Thom, a stress physiologist who was the study's lead researcher.

"It's like taking aspirin to combat heart disease," he said. "You reduce your risk."

When the men did not exercise, they had considerable difficulty controlling their racing emotion. But after exercise, they handled what they saw with more aplomb. Their moods were under firmer control.

The question of just how, physiologically, exercise blunts anger remains open. Mr. Thom and his colleagues did not test levels of stress hormones or brain chemicals in the test subjects. But earlier work by other scientists suggests that serotonin, a neurotransmitter in the brain, probably played a role, Mr. Thom said. "Animal studies have found that low levels of serotonin are associated with aggression, which is our best analogue of anger in animals," he said. "Exercise increases serotonin levels in the rat brain." Low serotonin levels in humans are also thought to contribute to mood disorders.

Changes in the activity of certain genes within the brain may also have an impact. In a 2007 experiment at Yale University, researchers found that prolonged running altered the expression of almost three dozen genes associated with mood in the brains of laboratory mice. Mr. Thom says he hopes that future studies by himself and others will help to determine the specific underlying mechanisms that link exercise and a reduction of anger.

But for now, the lesson of his preliminary work, he said, is that "if you know that you're going to be entering into a situation that is likely to make you angry, go for a run first."

http://well.blogs.nytimes.com/2010/08/11/phys-ed-can-exercise-moderate-anger/?ref=magazine

College Undergrads Study Ineffectively on Computers, Study Finds: Students Transfer Bad Study Habits from Paper to Screen

ScienceDaily (Aug. 10, 2010) — In the space of one generation, college students have gone from studying with highlighters and wire notebooks to laptops, netbooks and, now, iPads.But despite the prevalence of technology on campuses, a new study indicates that computers alone can't keep students from falling into their same weak study habits from their ink-and-paper days.

"Our study showed that achievement really takes off when students are prompted to use more powerful strategies when studying computer materials," said the University of Nebraska-Lincoln's Ken Kiewra, an expert in study methods and one of the authors of the study.The research, published in The *Journal of Educational Psychology*, found that students tend to study on computers as they would with traditional texts: They mindlessly over-copy long passages verbatim, take incomplete or linear notes, build lengthy outlines that make it difficult to connect related information, and rely on memory drills like re-reading text or recopying notes.

Meanwhile, undergraduates in the study scored 29 to 63 percentage points higher on tests when they used study techniques like recording complete notes, creating comparative charts, building associations, and crafting practice questions on their screens.Kiewra, a professor of educational psychology, calls the method SOAR: Selecting key lesson ideas, organizing information with comparative charts and illustrations, associating ideas to create meaningful connections, and regulating learning through practice. It complements how the brain processes information, he said.

"Learning occurs best when important information is selected from less important ideas, when selected information is organized graphically, when associations are built among ideas and when understanding is regulated through self-testing," Kiewra said.The study was built upon two experiments. In the first, undergraduates were questioned about how they study computer-based materials. In the second, they read an online text and then were asked to create on their computers some study materials that reflected their preferred (and likely weak) way to study. Or, they were prompted to use all or parts of SOAR study methods.

The latter group of studiers scored higher on tests measuring fact and relationship learning than the first group.Kiewra authored the new study with former UNL graduate student Dharmananda Jairam, at Penn State University, and said the study shows that as undergraduates spend more and more study time on computers, it will be vital for them to learn better ways of processing and then making use of information.Teachers and designers of instructional software may want to take note of the study's findings, as well.

"Teachers need to help students dispel crippling studying myths such as highlighting, outlining and rehearsal, and instead teach them strategies that help them succeed," Kiewra said.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Nebraska-Lincoln**.

http://www.sciencedaily.com/releases/2010/08/100810094617.htm?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed:+sciencedaily+%28ScienceDaily:+Latest+Science+News%29&utm_content=Twitter

Plagiarism Is Not a Big Moral Deal

By STANLEY FISH

Stanley Fish on education, law and society.

During my tenure as the dean of a college, I determined that an underperforming program should be closed. My wife asked me if I had ever set foot on the premises, and when I answered "no," she said that I really should do that before wielding the axe.

And so I did, in the company of my senior associate dean. We toured the offices and spoke to students and staff. In the course of a conversation, one of the program's co-directors pressed on me his latest book. I opened it to the concluding chapter, read the first two pages, and remarked to my associate dean, "This is really good."

It's hard to get from the notion that you shouldn't appropriate your neighbor's car to the notion that you should not repeat his words without citing him.

But on the way back to the administration building, I suddenly flashed on the pages I admired and began to suspect that the reason I liked them so much was that I had written them. And sure enough, when I got back to my office and pulled one of my books off the shelf, there the pages were, practically word for word. I telephoned the co-director, and told him that I had been looking at his book, and wanted to talk about it. He replied eagerly that he would come right over, but when he came in I pointed him to the two books — his and mine — set out next to each other with the relevant passages outlined by a marker.

He turned white and said that he and his co-author had divided the responsibilities for the book's chapters and that he had not written (perhaps "written" should be in quotes) this one. I contacted the co-author and he wrote back to me something about graduate student researchers who had given him material that was not properly identified. I made a few half-hearted efforts to contact the book's publisher, but I didn't persist and I pretty much forgot about it, although the memory returns whenever I read yet another piece (like one that appeared recently in The Times) about the ubiquity of plagiarism, the failure of students to understand what it is, the suspicion that they know what it is but don't care, and the outdatedness of notions like originality and single authorship on which the intelligibility of plagiarism as a concept depends.

Whenever it comes up plagiarism is a hot button topic and essays about it tend to be philosophically and morally inflated. But there are really only two points to make. (1) Plagiarism is a learned sin. (2) Plagiarism is not a philosophical issue.

Of course every sin is learned. Very young children do not distinguish between themselves and the world; they assume that everything belongs to them; only in time and through the conditioning of experience do they

learn the distinction between mine and thine and so come to acquire the concept of stealing. The concept of plagiarism, however, is learned in more specialized contexts of practice entered into only by a few; it's hard to get from the notion that you shouldn't appropriate your neighbor's car to the notion that you should not repeat his words without citing him.

The rule that you not use words that were first uttered or written by another without due attribution is less like the rule against stealing, which is at least culturally universal, than it is like the rules of golf. I choose golf because its rules are so much more severe and therefore so much odder than the rules of other sports. In baseball you can (and should) steal bases and hide the ball. In football you can (and should) fake a pass or throw your opponent to the ground. In basketball you will be praised for obstructing an opposing player's view of the court by waving your hands in front of his face. In hockey … well let's not go there. But in golf, if you so much as move the ball accidentally while breathing on it far away from anyone who might have seen what you did, you must immediately report yourself and incur the penalty. (Think of what would happen to the base-runner called safe at home-plate who said to the umpire, "Excuse me, sir, but although you missed it, I failed to touch third base.")

Golf's rules have been called arcane and it is not unusual to see play stopped while a P.G.A. official arrives with rule book in hand and pronounces in the manner of an I.R.S. official. Both fans and players are aware of how peculiar and "in-house" the rules are; knowledge of them is what links the members of a small community, and those outside the community (most people in the world) can be excused if they just don't see what the fuss is about.

Plagiarism is breach of disciplinary decorum, not a breach of the moral universe.

Plagiarism is like that; it's an insider's obsession. If you're a professional journalist, or an academic historian, or a philosopher, or a social scientist or a scientist, the game you play for a living is underwritten by the assumed value of originality and failure properly to credit the work of others is a big and obvious no-no. But if you're a musician or a novelist, the boundary lines are less clear (although there certainly are some) and if you're a politician it may not occur to you, as it did not at one time to Joe Biden, that you're doing anything wrong when you appropriate the speech of a revered statesman.

And if you're a student, plagiarism will seem to be an annoying guild imposition without a persuasive rationale (who cares?); for students, learning the rules of plagiarism is worse than learning the irregular conjugations of a foreign language. It takes years, and while a knowledge of irregular verbs might conceivably come in handy if you travel, knowledge of what is and is not plagiarism in this or that professional practice is not something that will be of very much use to you unless you end up becoming a member of the profession yourself. It follows that students who never quite get the concept right are by and large not committing a crime; they are just failing to become acclimated to the conventions of the little insular world they have, often through no choice of their own, wandered into. It's no big moral deal; which doesn't mean, I hasten to add, that plagiarism shouldn't be punished — if you're in our house, you've got to play by our rules — just that what you're punishing is a breach of disciplinary decorum, not a breach of the moral universe.

Now if plagiarism is an idea that makes sense only in the precincts of certain specialized practices and is not a normative philosophical notion, inquiries into its philosophical underpinnings are of no practical interest or import. In recent years there have been a number of assaults on the notion of originality, issuing from fields as diverse as literary theory, history, cultural studies, philosophy, anthropology, Internet studies. Single authorship, we have been told, is a recent invention of a bourgeois culture obsessed with individualism,

individual rights and the myth of progress. All texts are palimpsests of earlier texts; there's been nothing new under the sun since Plato and Aristotle and they weren't new either; everything belongs to everybody. In earlier periods works of art were produced in workshops by teams; the master artisan may have signed them, but they were communal products. In some cultures, even contemporary ones, the imitation of standard models is valued more than work that sets out to be path-breaking. (This was one of the positions in the famous quarrel between the ancients and the moderns in England and France in the 17th and 18th centuries.)

Arguments like these (which I am reporting, not endorsing) have been so successful in academic circles that the very word "originality" often appears in quotation marks, and it has seemed to many that there is a direct path from this line of reasoning to the conclusion that plagiarism is an incoherent, even impossible, concept and that a writer or artist accused of plagiarism is being faulted for doing something that cannot be avoided. R.M. Howard makes the point succinctly "If there is no originality and no literary property, there is no basis for the notion of plagiarism" ("College English," 1995).

That might be true or at least plausible if, in order to have a basis, plagiarism would have to stand on some philosophical ground. But the ground plagiarism stands on is more mundane and firm; it is the ground of disciplinary practices and of the histories that have conferred on those practices a strong, even undoubted (though revisable) sense of what kind of work can be appropriately done and what kind of behavior cannot be tolerated. If it is wrong to plagiarize in some context of practice, it is not because the idea of originality has been affirmed by deep philosophical reasoning, but because the ensemble of activities that take place in the practice would be unintelligible if the possibility of being original were not presupposed.

And if there should emerge a powerful philosophical argument saying there's no such thing as originality, its emergence needn't alter or even bother for a second a practice that can only get started if originality is assumed as a baseline. It may be (to offer another example), as I have argued elsewhere, that there's no such thing as free speech, but if you want to have a free speech regime because you believe that it is essential to the maintenance of democracy, just forget what Stanley Fish said — after all it's just a theoretical argument — and get down to it as lawyers and judges in fact do all the time without the benefit or hindrance of any metaphysical rap. Everyday disciplinary practices do not rest on a foundation of philosophy or theory; they rest on a foundation of themselves; no theory or philosophy can either prop them up or topple them. As long as the practice is ongoing and flourishing its conventions will command respect and allegiance and flouting them will have negative consequences.

This brings me back to the (true) story I began with. Whether there is something called originality or not, the two scholars who began their concluding chapter by reproducing two of my pages are professionally culpable. They took something from me without asking and without acknowledgment, and they profited — if only in the currency of academic reputation — from work that I had done and signed. That's the bottom line and no fancy philosophical argument can erase it.

http://opinionator.blogs.nytimes.com/2010/08/09/plagiarism-is-not-a-big-moral-deal/?hp

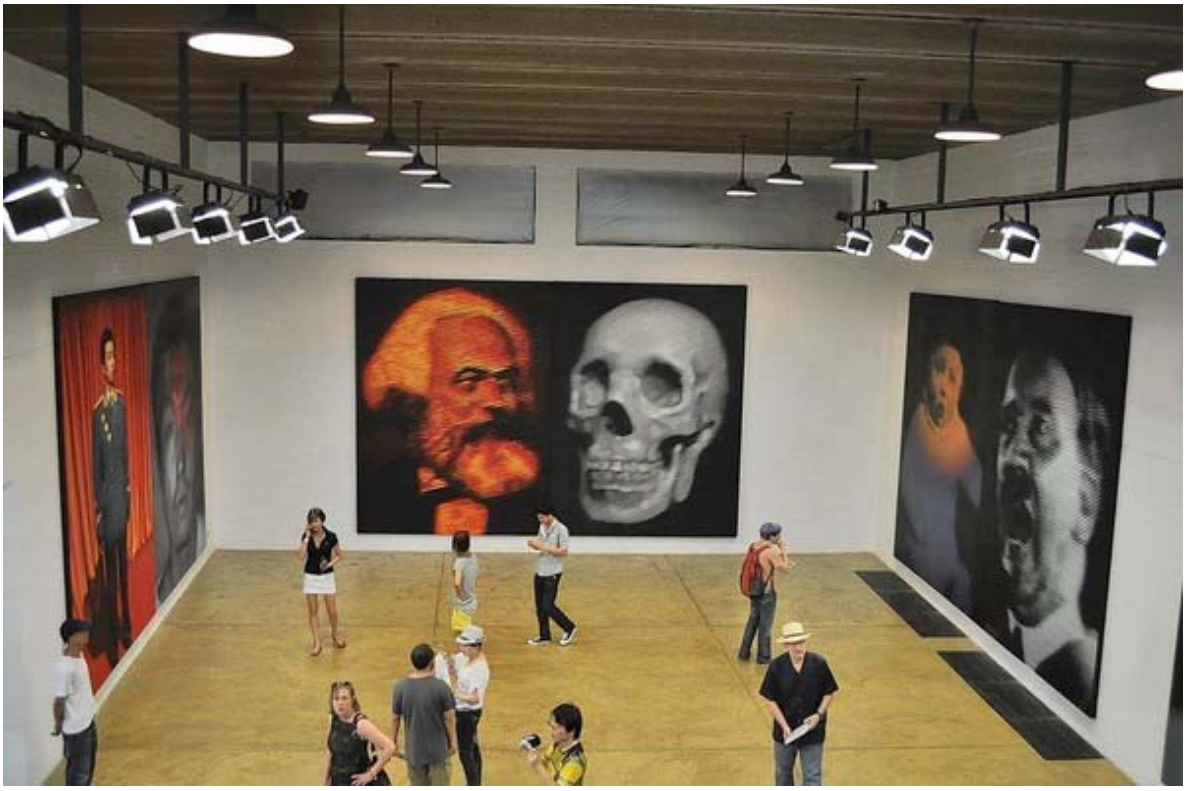
Artist brothers test Chinese boundaries

One of Gao Qiang and Zhen's exhibits shows multiple Maos aiming rifles at Jesus. Another features Hitler and Saddam Hussein. They don't consider themselves dissidents, just artists seeking the truth.

By Michael Gold, Los Angeles Times

August 11, 2010

Reporting from Beijing



Their weapons are brushes; their battlefields are canvases. And here in China, where political dissent often leads to prosecution, the works of avant-garde artists can sometimes appear as threatening as a mass protest.

Enter the Gao brothers, Qiang and Zhen, soft-spoken siblings who have long used startling images of Mao Tse-tung as a focal point for their sculptures, paintings and performance pieces.

"I don't consider myself a dissident at all," said Gao Qiang, 48. "I never even think about this question. I just use art to express what I want to express."

Regardless, they have become two of the most incendiary figures in the Chinese contemporary art world.

Over the years, authorities have raided their exhibits, confiscated their pieces, jailed their associates, and turned off the electricity in their studio. The brothers — who are scheduled to have their first solo show in Los Angeles in September — have been denied passports and were forbidden from leaving the Chinese mainland for more than a decade, up until 2003.

"The truth is not always something rosy," said Gao Zhen, 54. "Often it involves conflict, strife. I hope we can get at the truth through our art."

The recent opening of "Portraits," their latest exhibition in Beijing, served as an unambiguous reminder of the brothers' delicate position in a country that still places tight restrictions on freedom of expression, including art.

It was an invitation-only affair that benefited from no promotion besides a few e-mails to trusted members of the Gaos' inner circle, and took place at a venue so nondescript and tucked away that guests were personally shepherded in SUVs from a nearby highly commercial art district.

As a result, the overall atmosphere was intimate rather than exuberant, cautious as opposed to celebratory, a natural result of having to operate below the official radar.

The exhibit featured a series of portraits of famous 20th century dictators and radicals next to portraits of them as babies, all adapted from photos. They included Hitler, Saddam Hussein, Osama bin Laden and Kim Jong Il.

Overlaid with subtly shaded lines, as though from a grainy television broadcast, the portraits act as a commentary on modern media, casting a new light on the iconic "media portraits [that] have made them who they are remembered as today," said Melanie Ouyang Lum, an art critic and close friend of the Gaos.

The brothers' previous show, in September, was also of the underground variety. A sculpture of Mao, still a sacrosanct figure in China, knelt on the ground, hand on his heart and face racked with sorrow. In another piece, Mao figures pointed rifles at an unarmed Jesus.

Though "Portraits" doesn't address the government as directly as the Mao show, the artistic purpose is very much in the same vein: recasting familiar political images in shocking and unfamiliar ways.

"It's fine if people get shocked by the work or think it's sensationalist, but that's not the intention," Gao Qiang said. "I personally never get shocked by art because life itself in China is shocking enough."

That's what puts the brothers at the fore, said "Portraits" curator Ai Weiwei, who is no stranger to controversy, having served as a design consultant for the famed "Bird's Nest" Olympic stadium until he became a vocal critic of Beijing's handling of the 2008 Summer Games.

"Most Chinese artists just want to make money," Ai said during an interview in June at his Beijing studio. "They're filled with internal cowardice…. They're just looking for material success, and because of that the work becomes so empty."

The Gao brothers' art, on the other hand, is a stark appraisal of some of the most sensitive elements of Chinese society, from politicians to prostitutes, Ai said.

The brothers turned to art as an escape after their father, a factory worker, died during the Cultural Revolution, which roiled China in the 1960s and '70s. The brothers say he was tortured to death; the government said he committed suicide.

Inspired by the melancholia of such artists as Edvard Munch, the brothers started producing risque pieces in the 1980s, including "Midnight Mass," depictions of male genitalia made of condoms and balloons. Though the next 20 years saw a steady output of increasingly envelope-pushing work and frequent run-ins with authorities, the brothers said they've never been able to establish a sense of how far they can go, of what will or won't fly under official scrutiny.

"What might offend the government one day won't the next," Gao Qiang said. "There's no set rules or prescriptions."

Guests at the "Portraits" opening offered more specific theories of what might constitute a threat.

"Essentially, anything that offers different ideas and opinions to the single-party ideology," said Wu Wenjian, an artist who spent seven years in prison for taking part in the 1989 Tiananmen Square demonstrations.

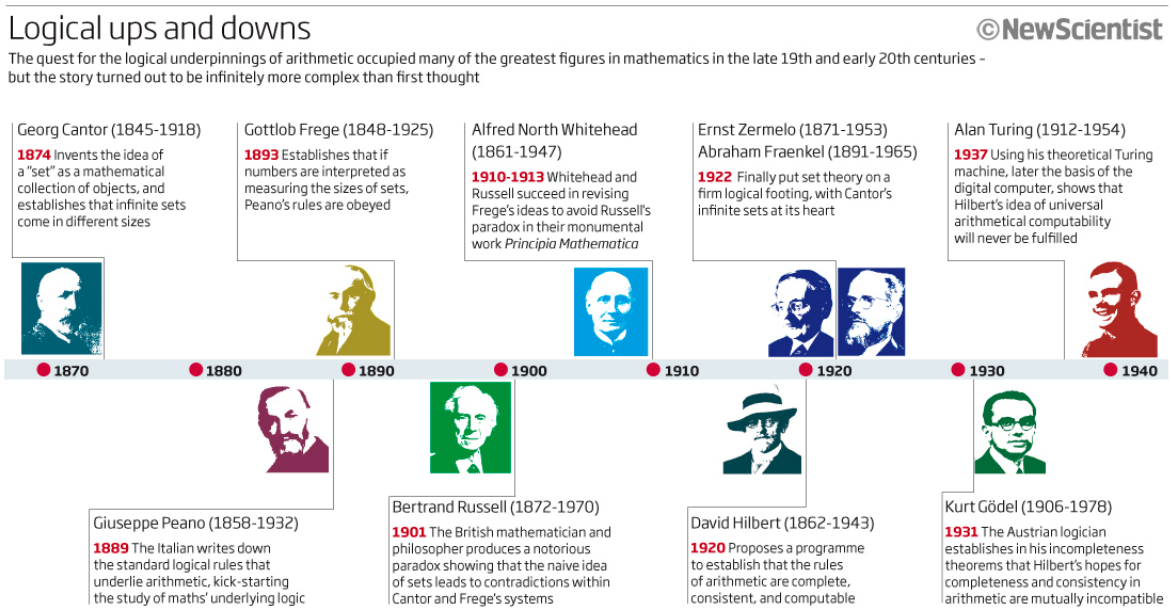
"There can only be one official voice in China."

Gold is a special correspondent.

http://www.latimes.com/news/nationworld/world/la-fg-china-gao-brothers-20100811,0,3797655.story

To infinity and beyond: The struggle to save arithmetic

- 11 August 2010 by **Richard Elwes**
- Magazine issue 2773.



Logical ups and downs

Mathematicians are facing a stark choice – embrace monstrous infinite entities or admit the basic rules of arithmetic are broken

IF YOU were forced to learn long division at school, you might have had cause to curse whoever invented arithmetic. A wearisome whirl of divisors and dividends, of bringing the next digit down and multiplying by the number you first thought of, it almost always went wrong somewhere. And all the while you were plagued by that subversive thought- provided you were at school when such things existed- that any sensible person would just use a calculator.

Well, here's an even more subversive thought: are the rules of arithmetic, the basic logical premises underlying things like long division, unsound? Implausible, you might think. After all, human error aside, our number system delivers pretty reliable results. Yet the closer mathematicians peer beneath the hood of arithmetic, the more they are becoming convinced that something about numbers doesn't quite add up. The motor might be still running, but some essential parts seem to be missing- and we're not sure where to find the spares.

From the 11-dimensional geometry of superstrings to the subtleties of game theory, mathematicians investigate many strange and exotic things. But the system of natural numbers- 0, 1, 2, 3, 4 and so on ad infinitum- and the arithmetical rules used to manipulate them retain an exalted status as mathematics' oldest and most fundamental tool.

Thinkers such as Euclid around 300 BC and Diophantus of Alexandria in the 3rd century AD were already probing the deeper reaches of number theory. It was not until the late 19th century, though, that the Italian Giuseppe Peano produced something like a complete set of rules for arithmetic: precise logical axioms from which the more complex behaviour of numbers can be derived. For the most part, Peano's rules seem self-evident, consisting of assertions such as if $x = y$, then $y = x$ and $x + 1 = y + 1$. It was nevertheless a historic achievement, and it unleashed a wave of interest in the logical foundations of number theory that persists to this day.

It was 1931 when a young Austrian mathematician called Kurt Gödel threw an almighty spanner in the works. He proved the existence of "undecidable" statements about numbers that could neither be proved nor disproved starting from Peano's rules. What was worse, no conceivable extension of the rules would be able to deal with all of these statements. No matter how many carefully drafted clauses you added to the rule book, undecidable statements would always be there (see "Bound not to work").

Gödel's now-notorious incompleteness theorems were a disconcerting blow. Mathematics prides itself on being the purest route to knowledge of the world around us. It formulates basic axioms and, applying the tools of uncompromising logic, uses them to deduce a succession of ever grander theorems. Yet this approach was doomed to failure when applied to the basic system of natural numbers, Gödel showed. There could be no assumption that a "true" or "false" answer exists. Instead, there was always the awkward possibility that the laws of arithmetic might not supply a definitive answer at all.

Gödel revealed the awkward possibility that arithmetic sometimes could not supply any answers at all

A blow though it was, at first it seemed it was not a mortal one. Although several examples of undecidable statements were unearthed in the years that followed, they were all rather technical and abstruse: fascinating to logicians, to be sure, but of seemingly little relevance to everyday arithmetic. One plus one was still equal to two; Peano's rules, though technically incomplete, were adequate for all practical purposes.

In 1977, though, Jeff Paris of the University of Manchester, UK, and Leo Harrington of the University of California, Berkeley, unearthed a statement concerning the different ways collections of numbers could be assigned a colour. It could be simply expressed in the language of arithmetic, but proving it to be true for all the infinitely many possible collections of numbers and colourings turned out to be impossible starting from Peano's axioms (see "The colour of numbers").

The immediate question was how far beyond Peano's rules the statement lay. The answer seemed reassuring: only a slight extension of the rule book was needed to encompass it. It was a close thing, but Gödel's chickens had once again missed the roost.

Now, though, they seem finally to have found their way home. In a forthcoming book, *Boolean Relation Theory and Incompleteness*, the distinguished logician Harvey Friedman of Ohio State University in Columbus identifies an entirely new form of arithmetical incompleteness. Like Paris and Harrington's theorem, these new instances, the culmination of more than ten years' work, involve simple statements about familiar items from number theory. Unlike Paris and Harrington's theorem, they lie completely out of sight of Peano's rule book.

To begin to understand what this new incompleteness is about, we must delve into the world of functions. In this context, a function is any rule that takes one or a string of natural numbers as an input and gives another

number as an output. If we have the numbers $x = 14$, $y = 201$ and $z = 876$ as the input, for example, the function $x + y + z + 1$ will produce the output 1092, and the function $xyz + 1$ will give 2,465,065.

These simple functions belong to a sub-class known as strictly dominating functions, meaning that their output is always bigger than their inputs. A striking fact, known as the complementation theorem, holds for all such functions. It says there is always an infinite collection of inputs that when fed into the function will produce a collection of outputs that is precisely the non-inputs. That is to say, the inputs and outputs do not overlap- they are "disjoint sets" - and can be combined to form the entire collection of natural numbers.

Delayed triumph

As an example, consider the basic strictly dominating function that takes a single number as its input and adds 1 to it. Here, if you take the infinite set of even numbers 0, 2, 4, 6, 8, 10... as the inputs, the corresponding outputs are the odd numbers 1, 3, 5, 7, 9, 11... Between them, these inputs and outputs cover every natural number with no overlap. The complementation theorem assures us that a configuration like this always exists for any strictly dominating function, a fact that can be deduced from Peano's rules.

Friedman's work entails adjusting the complementation theorem to pairs of a specific class of strictly dominating function known as expansive linear growth (ELG) functions. Friedman identified 6561 relationships between inputs and outputs that a pair of ELG functions could exhibit in principle. For every one of these relationships, he tested the hypothesis that it would be shown by every possible pair of ELG functions.

Friedman found that Peano's rules gave a definitive yes or no answer in almost all cases. The relationship either popped up with every pair of ELG functions, or he found a specific pair whose inputs and outputs could not be linked in that way. In 12 cases, however, he drew a blank: the hypothesis could neither be proved nor disproved using Peano's axioms. What's more, it could not be proved using any reasonable extension of conventional arithmetic. With Friedman's work, it seems Gödel's delayed triumph has arrived: the final proof that if there is a universal grammar of numbers in which all facets of their behaviour can be expressed, it lies beyond our ken.

What does this mean for mathematics, and for fields such as physics that rely on the exactitude of mathematics? In the case of physics, probably not much. "Friedman's work is beautiful stuff, and it is obviously an important step to find unprovable statements that refer to concrete structures rather than to logical abstractions," says theoretical physicist Freeman Dyson of the Institute for Advanced Studies in Princeton, New Jersey. "But mathematics and physics are both open systems with many uncertainties, and I do not see the uncertainties as being the same for both." The clocks won't stop or apples cease to fall just because there are questions we cannot answer about numbers.

The most severe implications are philosophical. The result means that the rules we use to manipulate numbers cannot be assumed to represent the pure and perfect truth. Rather, they are something more akin to a scientific theory such as the "standard model" that particle physicists use to predict the workings of particles and forces: our best approximation to reality, well supported by experimental data, but at the same time manifestly incomplete and subject to continuous and possibly radical reappraisal as fresh information comes in.

The rules we use to manipulate numbers might not be universal truths, but just our best approximation of reality

Cardinal sins

That is an undoubted strike at mathematicians' self-image. Friedman's work does offer a face-saving measure, but it too is something that many mathematicians are reluctant to countenance. The only way that Friedman's undecidable statements can be tamed, and the integrity of arithmetic restored, is to expand Peano's rule book to include "large cardinals"- monstrous infinite quantities whose existence can only ever be assumed rather than logically deduced (see "A ladder of infinities").

Large cardinals have been studied by logicians for a century, but their intangibility means they have seldom featured in mainstream mathematics. A notable exception is the most celebrated result of recent years, the proof of Fermat's last theorem by the British mathematician Andrew Wiles in 1994. This theorem states that Pythagoras's formula for determining the hypotenuse of a right angled triangle, $a^2 + b^2 = c^2$, does not work for any set of whole numbers a, b and c when the power is increased to 3 or any larger number.

To complete his proof, Wiles assumed the existence of a type of large cardinal known as an inaccessible cardinal, technically overstepping the bounds of conventional arithmetic. But there is a general consensus among mathematicians that this was just a convenient short cut rather than a logical necessity. With a little work, Wiles's proof should be translatable into Peano arithmetic or some slight extension of it.

Friedman's configurations, on the other hand, lay down an ultimatum: either admit large cardinals into the axioms of arithmetic, or accept that those axioms will always contain glaring holes. Friedman's own answer is unequivocal. "In the future, large cardinals will be systematically used for a wide variety of concrete mathematics in an essential, unremovable way," he says.

Not everyone is happy to take that lying down. "Friedman's work is beautiful mathematics, but pure fiction," says Doron Zeilberger of Rutgers University in Piscataway, New Jersey. He has a radically different take. The problems highlighted by Friedman and others, he says, start when they consider infinite collections of objects and realise they need ever more grotesque infinite quantities to patch the resulting logical holes. The answer, he says, is that the concept of infinity itself is wrong. "Infinite sets are a paradise of fools," he says. "Infinite mathematics is meaningless because it is abstract nonsense."

Rather than patching each hole with ever more dubious infinities, Zeilberger says we should focus our efforts on the only place where we really be sure of our footholds - strictly finite mathematics. When we do that, the incompleteness that creeps in at the infinite level will dissolve, and we can hope for a complete and consistent, albeit truncated, theory of arithmetic. "We have to kick the misleading word 'undecidable' from the mathematical lingo, since it tacitly assumes that infinity is real," he says. "We should rather replace it by the phrase 'not even wrong'. In other words, 'utter nonsense' ".

Such "finitist" views are nothing new. They appeared as soon as Georg Cantor started to investigate the nature of infinity back in the late 19th century. It was a contemporary of Cantor's, Leopold Kronecker, who coined the finitist motto: "God created the integers; all else is the work of man." But can we dismiss infinity that easily? Many mathematicians believe not, but we now know that even by accepting even the lowliest, most manageable form of infinity- that embodied by the "countable" set of natural numbers- we usher in a legion of undecidable statements, which in turn can only be tamed by introducing the true giants of the infinite world, the large cardinals.

The debate will rage on. The two possible conclusions are equally unpalatable. We can deny the existence of infinity, a quantity that pervades modern mathematics, or we must resign ourselves to the idea that there are certain things about numbers we are destined never to know.

Bound not to work

In the 1920s, David Hilbert laid down a grand challenge to his fellow mathematicians: to produce a framework for studying arithmetic, meaning the natural numbers together with addition, subtraction, multiplication and division, with Giuseppe Peano's axioms as its backbone. Such a framework, Hilbert said, should be consistent, so it should never produce a contradiction such as 2 + 2 = 3. And it should be complete, meaning that every true statement about numbers should be provable within the framework.

Kurt Gödel's first incompleteness theorem, published in 1931, killed that aspiration dead by encoding in arithmetical terms the statement "this statement is unprovable". If the statement could be proved using arithmetical rules, then the statement itself is untrue, so the underlying framework is inconsistent. If it could not be proved, the statement is undeniably true, but that means the framework is incomplete.

In a further blow, Gödel showed that even mere consistency is too much to ask for. His second incompleteness theorem says that no consistent framework for arithmetic can ever be proved consistent under its own rules.

The *coup de grâce* was delivered a few years later, when Briton Alan Turing and American Alonzo Church independently proved that another of Hilbert's demands, that of "computability", could not be fulfilled: it turns out to be impossible to devise a general computational procedure that can determine whether any statement in number theory is true or false.

The colour of numbers

When Jeff Paris and Leo Harrington got their glimpse of arithmetical incompleteness in 1977, they were considering a variant on a classic mathematical result called Ramsey's theorem. Suppose we have some scheme for assigning one of two colours, either red or blue, to every possible set of four natural numbers. So {1, 5, 8, 101} might be red for example, and {101, 187, 188, 189} might be blue. It is quite possible, then, that any given number will occur in some red sets and some blue sets. What Ramsey's theorem says is that, despite this, we can always find an infinite collection of numbers that is monochromatic - coloured entirely red or blue. There's nothing magic about sets of four numbers or two colours: change those to any figures you like, and the same thing works.

The theorem means order can be recovered even from highly disordered situations: even if you invent some horribly complex rule to colour your sets of numbers, you will always be able to extract an infinite monochromatic set. In theoretical computer science, for example, that permits algorithms to be constructed that allow the transfer of information through noisy channels where errors can creep in.

The variant of Ramsey's theorem considered by Paris and Harrington deals with sets of numbers that are "big", meaning that their smallest entry is less than the number of members in the set. So the set of four numbers {5, 7, 8, 100} is not deemed big as its smallest entry is 5, while the set {3, 8, 12, 100} is. If we start with a very big (but not infinite) set of natural numbers A, and again assign every set of four numbers within A either the colour red or blue, the modified version of Ramsey's theorem says we can find a monochromatic

subset of A that is big. Again, the same result should hold with the numbers four and two replaced with any other numbers.

Therein lies the problem. Paris and Harrington showed that for the theorem to hold, the set A must be mind-bogglingly large- too huge, in fact, to be described by arithmetical procedures stemming only from Peano's rules.

A ladder of infinities

How big is infinity? A silly question, you might say, as infinity is infinitely big. Perhaps, but as the 19th-century German mathematician Georg Cantor proved to his contemporaries' dismay, the infinite comes in different sizes.

Take the natural numbers: 0, 1, 2, 3, 4, 5... You can go on counting these till kingdom come, so there's no doubting that the set of natural numbers is infinite. But this "countable" infinity occupies only the lowest rung of an infinite ladder. Ironically, larger infinities arise when you break down the natural numbers into subsets: the numbers 1 to 1,000,000, for example, or the odd numbers, the prime numbers, or pairs of numbers such as four and 1296.

How many such subsets are there altogether? An infinite number, of course. Cantor was able to prove that this infinity is bigger than the original countable set. This second level of infinity is the "continuum", and it is where many important mathematical objects live: the set of real numbers (the integers and all the fractional and irrational numbers that lie between them) and the complex numbers too.

And so it goes on. By looking at the collection of all possible subsets of real numbers, you find a still higher level of infinity, and so on ad infinitum. Infinity is not a single entity, but an infinite ladder of infinities, with each rung infinitely higher than the one below. Mathematicians call these different levels the "infinite cardinals".

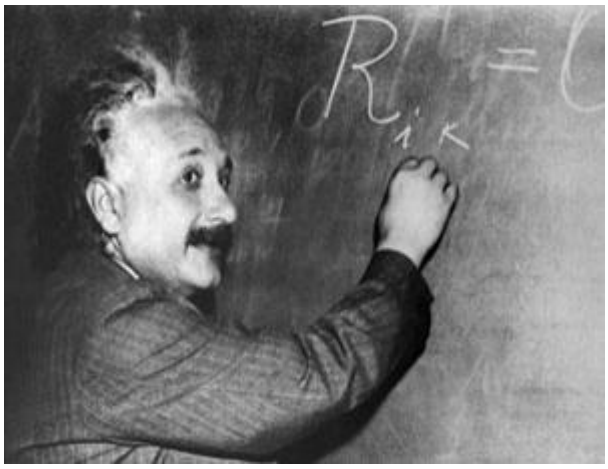
In 1908, another German mathematician, Felix Hausdorff, conceived the idea of "large cardinals". These dwarf even the hugest of Cantor's original cardinals and are blessed with a hierarchy all their own. They are too far up even to be seen from below, and whether or not they exist is a question utterly beyond the range of all the ordinary rules of mathematics. Small wonder, then, that many mathematicians baulk at the claim that large cardinals could rescue the logical foundations of arithmetic (see main story).

Richard Elwes is a visiting fellow at the University of Leeds in the UK and the author of Maths 1001: Absolutely Everything That Matters in Mathematics (Quercus, 2010)

http://www.newscientist.com/article/mg20727731.300-to-infinity-and-beyond-the-struggle-to-save-arithmetic.html?DCMP=NLC-nletter&nsref=mg20727731.300

E=mc^2? Not on Conservapedia

- 23:50 11 August 2010 by **Amanda Gefter** and **Celeste Biever**



Einstein had a complicated relationship with religion (Image: AFP/Getty)

Religious believers have quite the love/hate relationship with Albert Einstein. You'll often hear them quoting the physicist's comments about God not playing dice with the universe to support their own views – despite the fact that Einstein himself said, "I do not believe in a personal God." One young-Earth creationist site even uses an Einstein quote in a diatribe against evolution. Now the pendulum is swinging over to hate as Einstein goes the way of Darwin, becoming an unlikely Christian enemy.

It seems that the folks at Conservapedia – a sort of conservative alternative to the more familar online encyclopedia Wikipedia – are not fans of Einstein's most famous theory, general relativity. In fact, they view it as a far-reaching liberal conspiracy.

The website TPMMuckracker recently drew attention to a page on the site titled "Counterexamples to relativity". It says: "The theory of relativity is a mathematical system that allows no exceptions. It is heavily promoted by liberals who like its encouragement of relativism and its tendency to mislead people in how they view the world."

In a footnote, this comment is followed up by: "Virtually no one who is taught and believes relativity continues to read the Bible, a book that outsells *New York Times* bestsellers by a hundred-fold."

Does relativity really steer people away from God? Or maybe – and this is just a theory, to use their favourite phrase – the same kinds of people who study general relativity are simply less likely to consult the Bible for answers to the questions of the universe.

Action at a distance

The Conservapedia page then lists 30 counterexamples to general relativity, any of which, it claims, "shows that the theory is incorrect". Many of these are bizarre, such as "the action-at-a-distance by Jesus, described in John 4:46-54." Apparently, Jesus's ability to instantaneously heal a child from a distance – his healing powers travelled through space faster than the speed of light – was evidence enough to rule out Einstein's theory. Of course, Jesus wasn't the only one to appear to violate Einstein's cosmic speed limit. So-called entangled quantum particles do it in labs all the time. (Church of the Entanglement, anyone?)

Scanning further pages on Conservapedia, it seems that the religious right's beef with Einstein runs deep. Just as evolution dissenters say they are being deprived of their "academic freedom", relativity deniers claim they are now in the same boat. "Despite censorship of dissent about relativity, evidence contrary to the theory is discussed outside of liberal universities," reads the website's main article on relativity.

In reality, general relativity has passed every experimental test to which it's been put – but Conservapedia isn't satisfied. They refer to a 1919 solar eclipse expedition that bore out the theory's prediction that starlight would be bent by the sun's gravity as "a dramatic but later discredited claim by Sir Arthur Eddington of experimental proof of general relativity". It's true that Eddington's results had large uncertainties, but the experiment has been tested and retested and the data holds up every time.

Enter Obama

Read further and you will find this astonishing piece of information, clearly the smoking gun of the Einsteinian liberal conspiracy: "Barack Obama helped publish an article by liberal law professor Laurence Tribe to apply the relativistic concept of 'curvature of space' to promote a broad legal right to abortion".

Wait. What? The article in question is "The Curvature of Constitutional Space: What lawyers can learn from modern physics" (pdf) by Laurence Tribe, a professor of constitutional law at Harvard Law School. Published in 1989 in the *Harvard Law Review*, the paper includes a "thank you" to Barack Obama in the acknowledgments, an unsurprising fact given that Obama was the journal's editor at the time.

In the article, Tribe uses metaphors of space-time curvature in the context of constitutional law, including an analysis of Roe v. Wade. "I do not address the subject because I am determined to bring science or mathematics into law," he writes. "Rather, my conjecture is that the metaphors and intuitions that guide physicists can enrich our comprehension of social and legal issues."

General relativity proposes that space-time is not an inert stage upon which the world plays out but rather a dynamic medium that is warped and curved by the presence of matter and in turn affects matter's motion. Tribe argues that constitutional law is likewise not only the backdrop against which the nation's affairs play out but a dynamic force that shapes those very affairs. In summary, Tribe writes, "The question is whether the state's combination of acts and omissions, rules, funding decisions and the like, so shaped the legal landscape in which women decide matters bearing on their reproductive lives as to violate the constitution's postulates of liberty and equality."

'Theory of invariance'

Nearly two decades later, physicist Frank Tipler took on Tribe's paper in an article on the Social Science Research Network entitled "The Obama-Tribe 'Curvature of Constitutional Space' Paper is Crackpot Physics". Coming from a physicist who authored the book *The Physics of Christianity*, in which he claims that without Jesus's resurrection, our universe couldn't exist, I am forced to question the meaning of "crackpot". It's no matter, though, because Tribe's grasp of general relativity is irrelevant – he was not writing a scientific paper, he was merely creating an analogy. But for Andy Schlafly, founder of Conservapedia and son of anti-abortion activist Phyllis Schlafly, the analogy was apparently enough to turn him off Einstein for good.

Despite the fact that it has passed test after test, you would be hard-pressed to find a single physicist who believes that general relativity is ultimately the correct theory of the universe. That's because it conflicts with quantum mechanics and is yet to be unified with the other three forces of nature. A theory of quantum gravity such as string theory will be needed to pick up where Einstein left off. General relativity is certainly not wrong – but it's not the whole story.

In the end there is no liberal conspiracy at work. Unfortunately, humanities scholars often confuse the issue by misusing the term "relativity". The theory in no way encourages relativism, regardless of what Conservapedia may think. The theory of relativity is ultimately not so much about what it renders relative – three dimensional space and one-dimensional time – but about what it renders absolute: the speed of light and four-dimensional space-time. Einstein himself lamented the name "relativity", wishing instead to call his theory the theory of invariance. The name change might have avoided this whole mess.

http://www.newscientist.com/article/dn19303-emc2-not-on-conservapedia.html

Fasting mothers raise potential risk for unborn babies

- 11 August 2010
- Magazine issue 2773.

AS RAMADAN begins this week, pregnant women deciding whether to take part in the customary fast may wish to consider the effect on their babies.

So says Nick Ashton at the University of Southampton, UK, and colleagues at King Saud University in Riyadh, Saudi Arabia. They analysed records of 7000 babies born in a Saudi hospital over a four-year period, and worked out during which trimester, if any, of their mother's pregnancy Ramadan fell. Surveys indicate that over 90 per cent of pregnant Muslim women fast.

While babies' birth weights were similar in fasting and non-fasting Saudi women, the placentas of women who had fasted during the second or third trimester were 3 per cent lighter than average when the child was a boy and 1.5 per cent lighter for girls (*Placenta*, DOI: 10.1016/j.placenta.2010.04.010).

Children born with placentas that are smaller than average are known to have an increased risk of cardiovascular disease later in life, though it is too early to advise pregnant women whether to fast, Ashton says. "Birth weight isn't affected, which is good, but we need to see whether a small placenta affects the risk of cardiovascular disease in these children in the long term."

http://www.newscientist.com/article/mg20727734.200-fasting-mothers-raise-potential-risk-for-unborn-babies.html

Hydrogen bombshell: Rewriting life's history

- 11 August 2010 by **Nick Lane**

Magazine issue 2772.

No need for oxygen (Image: Brian Larossa)

Oxygen is supposed to have driven the evolution of complex life – but the discovery of animals that thrive without it tells a different story

GO WEST, young man! More specifically, go about 200 kilometres west of Crete, then straight down to the bottom of the Mediterranean Sea 3.5 kilometres below. There you will find a lake with some extraordinary inhabitants.

Around 6 million years ago when the Mediterranean nearly dried up, vast amounts of salt were deposited on the sea floor. Some of these deposits were exposed about 30,000 years ago. As this salt dissolves, extra-salty, dense water is sinking to the depths, forming a brine lake up to 60 metres deep. Even more surprising than the existence of this lake beneath the sea, however, is what lives in it.

The water in the brine lake does not mix with the water above and so ran out of oxygen long ago. Instead, the toxic gas hydrogen sulphide oozes from the black mud. It's the last place you would expect to find animals. But that's exactly what has been discovered: the first animals, as far as we know, that can grow and reproduce without a whiff of oxygen.

These tiny mud-dwellers are far more than a curiosity. They could be the best pointer yet to the origin of complex cells: the basis of most life on Earth, from amoebae to oak trees.

Radical prediction

"The ecology is interesting, but the real significance of these critters is what they say about evolution," says Bill Martin, an evolutionary biologist at the University of Dusseldorf in Germany. For Martin, the discovery

is a beautiful affirmation of a radical prediction he made more than a decade ago - that oxygen had nothing to do with the evolution of complex life.

The first kinds of life on Earth, the bacteria and archaea, were simple cells - not much more than bags of chemicals. Eventually, they gave rise to complex cells, or eukaryotes, with sophisticated internal structures, the kind of cells found inside all plants and animals. And one of the most important events in the evolution of complex cells was the formation of a symbiotic union between a host cell and a bacterium - the ancestor of the cellular powerhouses known as mitochondria, which extract energy from food using oxygen.

"Burning" food provides 10 times as much energy as alternative ways of extracting energy from food without oxygen. When complex cells gained this ability, it changed the course of life on Earth: without mitochondria, large active animals might never have evolved (see "Living without breathing"). It is not surprising, then, that most biologists think that the original symbiotic union revolved around oxygen. According to Martin, though, they are utterly wrong.

Mass extinction

The narrative in the textbooks seems compelling. In the beginning, so the story goes, there was no oxygen. The evolution of photosynthesis changed all that. By releasing their waste - oxygen - into the air, cyanobacteria transformed the globe around 2.3 billion years ago. As oxygen levels rose, the toxic gas caused the first mass extinction, wiping out nearly all existing organisms and paving the way for a new lifestyle: extracting energy from food using oxygen.

The bacteria that evolved this ability were preyed on by other cells. At some point, one cell failed to digest its dinner and instead let the bacteria live on inside it. This host cell, so the story goes, got two huge benefits: protection against oxygen, which was guzzled up by the ancestral mitochondria, and a share of the extra energy its guests could extract from food using oxygen.

It was not until oxygen levels rose even higher, around half a billion years ago, that the oceans could support large multicellular organisms that got their energy by burning food. That led to the Cambrian explosion, when all kinds of animals appeared. The main point about this story is that it sweeps forward with a magisterial inevitability, waiting only on a rising tide of oxygen.

The broad outlines are true. Oxygen levels did rise in two steps; most eukaryotes do generate energy using oxygen, and are normally tolerant of its toxicity; and the earliest fossil animals did appear soon after a big rise in oxygen levels in the oceans. Yet there are grounds to suspect that oxygen was not the puppet master after all.

One is that the initial rise in oxygen did not cleanse the oceans, but converted them into a stinking mess, full of hydrogen sulphide. Far from having few refuges, anaerobes had whole oceans to themselves. What's more, these conditions lasted for more than a billion years, right through the period when the eukaryotes are thought to have evolved.

No free lunch

Another issue is that oxygen is not particularly toxic by itself - it needs to be converted into free radicals before it will react with and destroy proteins and DNA. Mitochondria generate lots of free radicals so, far

from protecting their hosts from oxygen, their ancestors would have increased the damage it does. In any case, consuming oxygen merely steepens the diffusion gradient; it's like trying to save yourself from drowning by drinking the surrounding ocean.

Even the power advantage of oxygen is problematic. No bacterium gives away energy for free, so the host cell could not have benefited from oxygen respiration until it had evolved the kit needed to siphon off energy-rich ATP from its guest bacteria. In the meantime, the "symbiosis" would have been a disaster. Thanks to their ability to exploit oxygen, the bacteria would be likely to outgrow the host and end up killing it.

So if the union was not about oxygen, what was it about? Hydrogen, according to Martin and Miklos Müller of The Rockefeller University in New York.

Hydrogenosomes

Back in the 1970s, Müller discovered that some single-celled organisms have structures that resemble mitochondria but do something quite different; they generate energy without using oxygen, by breaking food down into carbon dioxide and hydrogen - so Müller called them hydrogenosomes.

Before hooking up with Martin, Müller had gone on to show that hydrogenosomes do not merely resemble mitochondria but are in fact stripped-down mitochondria. They have the same shell, yet completely lack the usual ATP-generating machinery driven by oxygen. Instead, they have machinery that generates ATP while creating hydrogen as waste. The question is, was this different machinery acquired as mitochondria evolved into hydrogenosomes, or was it present all along? And if it was present all along, then what did the bacterial ancestor of the mitochondria actually look like?

Martin and Müller leapt straight in at the deep end. The ancestor of mitochondria, they said, was a versatile bacterium capable of living in a variety of environments - it could use many substances, including oxygen, to produce energy, and it could make hydrogen too. This is hardly an imaginary superbug: existing bacteria like *Rhodobacter* can do all that and more.

The ability of ancestral mitochondria to make hydrogen, rather than use oxygen, was the basis of the primordial pact that gave rise to the eukaryotes, Martin and Müller argued. The bacteria produced hydrogen as waste, and the host cell used it to convert carbon dioxide into methane, gleaning a little energy from the process - just as many archaea, called methanogens, still do. The symbiosis began in an environment with little or no oxygen and only later, after the relationship was well established, did the host cell start exploiting the ability of the ancestral mitochondria to use oxygen.

This idea, known as the "hydrogen hypothesis", was proposed by Martin and Müller in 1998 (*Nature*, vol 392, p 37), but it has never gained widespread acceptance. It was not just up against the gut feeling of most researchers that the rise of the eukaryotes was related in some way to oxygen; on the face of it, what little evidence there was did not support it either.

Most studies of the genes needed to make hydrogenosomes, for example, suggest they evolved repeatedly and independently from mitochondrial genes, with some extra ones being picked up by lateral gene transfer from other organisms along the way. "I think the transformation from aerobic mitochondria to hydrogenosomes has little or nothing to do with the origins of eukaryotes," says microbiologist Mitch Sogin at the Marine Biological Laboratory in Woods Hole, Massachusetts.

Not surprisingly, Martin disagrees. "Single gene studies are subject to so many artefacts that we can conclude almost nothing about deep evolutionary history from them," he says. "Line up the same genes from the other end and you derive a totally different tree."

What's more, if aerobic mitochondria have evolved into hydrogenosomes on many separate occasions by picking up genes from other organisms, then why do hydrogenosomes always have the same small subset of genes for making hydrogen? They could have picked up all kinds of genes from bacteria, which have an amazing repertoire of metabolic abilities, Martin says, so why pick the same ones each time?

Remarkable abilities

Martin's explanation is simple: they share the same set because they inherited them from a single bacterium - the ancestor of mitochondria. For all its power, this argument is sterile without more evidence one way or another: you either believe it or you don't.

That evidence is starting to emerge. Take *Chlamydomonas*, a unicellular green alga with remarkable metabolic abilities. Ariane Atteia and her colleagues at the Laboratory of Plant Cell Physiology in Grenoble, France, together with Martin, have been studying its mitochondria. Last year, they concluded that the ancestor of these mitochondria was a metabolically versatile bacterium like *Rhodobacter* (*Molecular Biology and Evolution*, vol 26, p 1533).

Meanwhile, Lillian Fritz-Laylin and her colleagues at the University of California, Berkeley, have been looking at *Naegleria gruberi*, a curious shape-changing cell. In the absence of oxygen, its mitochondria appear capable of generating energy by producing hydrogen, the team reported earlier this year, with the help of proteins also found in hydrogenosomes (*Cell*, vol 140, p 631).

And now we have found animals that can live without oxygen lurking in brine lakes at the bottom of the Mediterranean. The three yet-to-be-named species were discovered by marine biologist Roberto Danovaro of the Polytechnic University of Marche in Ancona, Italy and his colleagues (*BMC Biology*, vol 8, p 30). They belong to an obscure group of microscopic animals, the Loricifera, found in ocean sediments around the world.

Little more than a millimetre long, the new species are so inactive that it took a while to prove they were indeed living, if not breathing. What's really striking about them, though, is not just their ability to live without oxygen but the way they manage it: unlike all other animals, including other Loriciferans, they appear to have hydrogenosomes rather than mitochondria.

These recent discoveries are starting to transform people's perspectives. "The simplest explanation is that all the different types of mitochondria inherited their metabolic tool kits from a single versatile ancestor," says Mark van der Giezen at the University of Exeter, UK, who studies the evolution of anaerobic eukaryotes.

And if that is the case, then eukaryotes would have been able to live in anoxic environments right from the start. "Nobody seriously thinks that bacteria dwelling in such habitats only recently adapted to anaerobic niches," points out Martin. "But when it comes to eukaryotes, there is still a curious tendency to assume that they only invaded anaerobic niches of late. There's no logic in that."

Indeed, if the hydrogen hypothesis is right, the implications for complex life are striking. The existence of animals that don't need oxygen means that oxygen is not the be-all and end-all of complex life in the universe. The anoxic oceans a billion years ago might have been full of tiny creatures - as indeed many anoxic basins probably are today, if we look properly - and these animals got larger and more active when oxygen levels rose.

Clearly, the existence of animals that don't need oxygen means oxygen is not the be-all and end-all of complex life in the universe

The deeper point relates to the origin of eukaryotes. There was no magisterial progression from simple to complex life as oxygen levels rose; no inevitability about it. Instead, there was a symbiotic union between a bacterium that could make hydrogen and an archaeal host cell that could exploit that hydrogen: a freak event that changed the world.

Living without breathing

Some fish, mussels and sediment-dwelling worms can live without oxygen for hours or even days. Instead of getting energy by "burning" food, the cells of these animals switch to ways of producing energy that do not require oxygen. Until earlier this year, no animals had been discovered that go their entire lives without oxygen (see main story) - it was thought to be impossible.

Oxygen is not only used for getting energy from food, it is also needed to make compounds like collagen, the "glue" that holds animals together. No oxygen, no collagen; no collagen, no animals, the thinking went. That must be wrong, although we have yet to work out how the newly discovered animals make compounds like collagen without oxygen.

So could there be planets out there with large animals that do not need oxygen? While burning food produces 10 times as much energy as other means like fermentation, in theory an animal might get around that if it could somehow get 10 times as much fuel. The trouble is, fermentation leaves far less energy for predators in ecosystems. With aerobic respiration, there can be five or six links in a food chain before the amount of energy falls below 1 per cent of that available initially. Without oxygen, this happens with just two links.

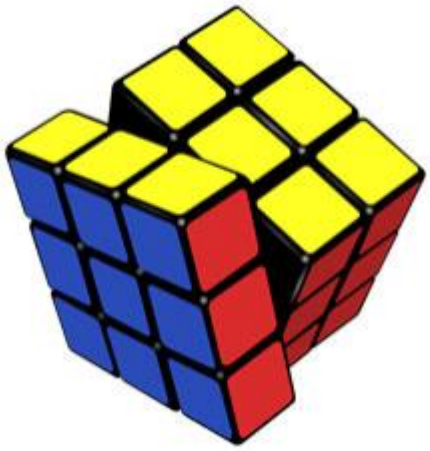
And with far less scope for predation, animals might not evolve as far or as fast; the need to find prey or dodge predators is thought to have driven the development of features like eyes and mouths and muscles.

Nick Lane is the first Provost's Venture Research Fellow at University College London, and author of Life Ascending: The ten great inventions of evolution (Profile, 2009)

http://www.newscientist.com/article/mg20727721.400-hydrogen-bombshell-rewriting-lifes-history.html

'God couldn't do faster': Rubik's cube mystery solved

- 17:28 11 August 2010 by **Jacob Aron**



God's favourite puzzle? (Image: Kleiner)

It has taken 15 years to get to this point, but it is now clear that every possible scrambled arrangement of the Rubik's cube can be solved in a maximum of 20 moves – and you don't even have to take the stickers off.

That's according to a team who combined the computing might of Google with some clever mathematical insights to check all 43 quintillion possible jumbled positions the cube can take. Their feat solves the biggest remaining puzzle presented by the Rubik's cube.

"The primary breakthrough was figuring out a way to solve so many positions, all at once, at such a fast rate," says Tomas Rokicki, a programmer from Palo Alto, California, who has spent 15 years searching for the minimum number of moves guaranteed to solve any configuration of the Rubik's cube.

The figure is dubbed "God's number", the assumption being that even the Almighty couldn't solve the puzzle faster. *New Scientist* reported in 2008 that Rokicki had reduced the value of God's Number to 22, but it was clear that bringing it down further would require some clever shortcuts.

Exploiting symmetry

To further simplify the problem, Rokicki and his team have now used techniques from the branch of mathematics called group theory .

First they divided the set of all possible starting configurations into 2.2 billion sets, each containing 19.5 billion configurations, according to how these configurations respond to a group of 10 possible moves.

This grouping allowed the team to reduce the number of sets to just 56 million, by exploiting various symmetries of a cube. For example, turning a scrambled cube upside down doesn't make it harder to solve, so these equivalent positions can be ignored.

That still left a vast number of starting configurations to check, however, so the team also developed an algorithm that speeds up this process.

Useful dead ends

Previous methods solved around 4000 cubes per second by attempting a set of starting moves, then determining if the resulting position is closer to the solution. If not, the algorithm throws those moves away and starts again.

Rokicki's key insight was to realise that these dead-end moves are actually solutions to a different starting position, which led him to an algorithm that could try out one billion cubes per second.

You can think of his solution like this. Imagine visiting a friend in an unfamiliar city. They've given you directions indicating when to turn left or right, but neglected to include a starting point. If you follow the directions from a random point it's unlikely you'll reach your destination, but matching them to the right starting point will definitely get you there.

Similarly, the team's algorithm rapidly matches moves to the correct starting point, allowing them to solve each set of 19.5 billion in under 20 seconds.

Computing empire

Even at this speed, completing the entire task would take around 35 years on an ordinary computer. So the team's solution relies on another shortcut: John Dethridge, an engineer at Google in Mountain View, California, was able to use his employers' vast computing empire to solve the problem in a matter of weeks.

We've known for 15 years that some configurations of the cube require just 20 moves to solve – and many mathematicians suspected that none needed more. The team's exhaustive search proves them right

"Research like this shows how pure mathematics can often be used to make hard computational problems more feasible," says Mark Kambites, a mathematician at the University of Manchester who was not involved in the team's work. "The Rubik's cube is an interesting test case for the methods of computational group theory."

The work has not yet been peer reviewed but Rokicki points out that it is an extension of earlier work that was published in *The Mathematical Intelligencer*, which reduced God's number to 22.

http://www.newscientist.com/article/dn19301-god-couldnt-do-faster-rubiks-cube-mystery-solved.html

Mind-reading marketers have ways of making you buy

- 09 August 2010 by **Graham Lawton** and **Clare Wilson**

Magazine issue 2772.

Emotional response

Why ask people what they think of a product when you can just scan their brains instead? ***New Scientist*** *explores the brave new world of neuromarketing*

TAKE A look at the cover of this week's *New Scientist* magazine (right). Notice anything unusual? Thought not, but behind the scenes your brain is working overtime, focusing your attention on the words and images and cranking up your emotions and memory. How do we know? Because we tested it with a brain scanner.

In what we suspect is a world first, this week's cover was created with the help of a technique called neuromarketing, a marriage of market research and neuroscience that uses brain-imaging technology to peek into people's heads and discover what they really want. You may find that sinister. What right does anyone have to try to read your mind? Or perhaps you are sceptical and consider the idea laughable. But neuromarketing, once dismissed as a fad, is becoming part and parcel of modern consumer society. So we decided to take a good look at it - and try it out ourselves.

That is how several *New Scientist* readers ended up in a darkened room in London, wired up to an electroencephalograph (EEG) machine and being shown various magazine cover designs. Our aim - with the help of the European arm of neuromarketing company NeuroFocus, based in Berkeley, California - was to observe their reactions on a level that would not normally be possible. "I've been involved in market research for about 25 years," says Thom Noble, managing director of NeuroFocus Europe. "Every few years a new methodology comes out. Frankly, they're incrementally different. This is transformationally different."

Market research has traditionally relied on methods such as questionnaires and focus groups to gauge how consumers will respond to new products. These tools have their strengths, but they share one fatal weakness: they depend on asking people what they think. "What people say and what they think is not always the same," Noble says. "Conventional research really struggles with this."

It's not just that people are inclined to say what they think others want to hear, and to give answers that they think reflect favourably upon themselves. According to Gregory Berns, a neuroeconomist at Emory University in Atlanta, Georgia, the problem is that much of the decision-making process happens at a subconscious level, and experiments reveal that people are generally not very good at explaining the thinking behind their choices. "Sometimes they simply don't know why they chose things," he says. "They concoct explanations after the fact, or make up explanations that are socially acceptable. I do think there's loads of information contained in the brain that simply doesn't make it out."

The great hope of neuromarketing is to extract this hidden information directly from people's brains. "We're not asking questions at all - we're recording responses at a deep subconscious level," Noble says.

The approach used by Noble and other neuromarketers originated in university labs where, for over a decade, neuroeconomists have been trying to figure out what is going on inside our heads when we make economic decisions. Using brain-imaging techniques such as fMRI - which records brain activity via changes in blood flow - they have made all kinds of surprising discoveries.

Feel the love

One of the most important is that our decisions are much less rational than traditional economics suggests. "We find that emotions are really important," says Mirja Hubert, a consumer researcher at Zeppelin University in Friedrichshafen, Germany. "Even rational decisions are not possible without emotion." Emotions are also key to the elusive concept of "brand loyalty" - the often irrational preference for one version of a product over essentially identical competitors.

In a famous study published in 2004, Read Montague from Baylor College of Medicine in Houston, Texas, got loyal Coke drinkers to take the "Pepsi challenge" inside an fMRI machine. When they didn't know which drink they had been given, Pepsi triggered the most activity in the areas of the cortex responsible for rational thought and people said they preferred it. But when Montague told them in advance which cola was which, Coke provoked stronger activity in the emotion-related limbic system, and their stated preference switched (*Neuron*, vol 44, p 379). By triggering positive emotions, successful brands can override our rational choices.

Further research indicates that we build long-term emotional bonds with brands. These are established and maintained by messages that constantly associate the brand with positive emotions. Think of all those feel-good ads for cellphones, drinks, airlines and any number of other products. They are not trying to sell you a phone, a soda or a flight but to woo you into a long-term relationship. And no wonder: once people have

formed a relationship with one brand they are very resistant to the advances of others (*Advances in Consumer Research*, vol 34, p 1).

Another key discovery of neuroeconomics is that certain products trigger activity in brain systems that usually fire in anticipation of rewarding stimuli such as food, sex and addictive drugs. A team at the University of Ulm in Germany found, for example, that pictures of sports cars produced much stronger activity in these reward centres than pictures of other cars, in research funded by DaimlerChrysler (*Neuroreport*, vol 13, p 2499).

Wanted: reward

Neuroeconomists now think of the amount of activity in these regions as a sort of universal currency of desirability, allowing the brain to weigh up different rewards. "There's a lot of evidence that signals in these regions represent some kind of value," says Berns, "and that makes a lot of sense. We're always trying to make decisions between doing things that have value but are completely different, like going to the movies, going out for dinner or spending time with loved ones."

Findings such as these have encouraged market researchers to believe that they can access the hidden desires and preferences locked away inside consumers' heads. The past few years has seen a steady stream of businesses turning to companies such as NeuroFocus. Want to know if a new car design is pushing the right buttons? See if it revs the reward centres in the brain. Is this advert going to make people love our product? Measure the emotional response it generates.

Branding in particular is a marketer's nirvana, says Noble. "As more and more sectors become crowded, the difference between products - say, Smirnoff, Absolut and any other vodka - is frankly not that big. But the brands are completely different. It's the emotional content of the brand that we are trying to get a grip on."

Some neuromarketing companies use fMRI, the tool of choice for neuroeconomics, which is particularly good at identifying anatomical structures in three dimensions and localising brain activity. However, consumer researchers have misgivings about this approach because of the high costs and the technical challenges. Anyone having a brain scan has to stay very still: a head movement of a few millimetres over 20 minutes can ruin the data. Time resolution is also poor, with a lag of about 5 seconds between stimulus and the visible brain activity. That makes it hard to get useful information about things like TV adverts, which unfold on a second-by-second basis.

For these reasons, most neuromarketing companies - NeuroFocus included - go for EEG, a less technically challenging technique, which eavesdrops on brain activity via electrodes placed on the scalp. As well as being easier to use, EEG has a big advantage over fMRI in that it gives you real-time information. According to NeuroFocus's chief science adviser, neuroscientist Robert T. Knight at the University of California, Berkeley, an EEG trace can reveal the three things that market researchers really need to know: "Did you pay attention? Did it elicit emotions? Was it memorable?" If a product doesn't tick these three boxes then it won't succeed.

So does it work? With so much of what is going on in neuromarketing companies kept tightly under wraps, it is hard to say for sure, says Berns. Even so, he believes that insights from neuroeconomics will be useful, especially during product development. Tim Behrens, a neuroscientist at the University of Oxford, agrees, but has reservations about EEG. "If you had someone in an fMRI scanner and showed them your advert, I can imagine it would be useful in telling you whether they would be likely to buy stuff. I don't think it's flaky," he says. "But do EEG measures give useful information? I'm not sure."

The trouble is that EEG cannot locate precisely where the signals are coming from. So, for example, you cannot directly see activity in the brain's reward areas or emotional centres. However, neuroscientist Michael Smith at NeuroFocus in Berkeley says they can infer enough to get useful information by using various other measures and looking for certain characteristic patterns of neural activity (see "Mind-reading marketers").

A study done last year seems to confirm this. An international cosmetics firm tested two subtly different versions of an advert using a traditional focus group. They found that one was much preferred over the other, even though volunteers failed to notice any difference between them. This was hardly surprising as they only differed in one 4-second scene in which a female model either looked passively at the camera or touched her cheek with the back of her hand. To find out why this made such an impact, the company hired a group of neuroscientists led by Rafal Ohme of the Polish Academy of Sciences in Warsaw. Using EEG imaging of 45 women aged between 25 and 35, they found that the gesture produced a brief but powerful emotional uplift during the crucial scene (*Journal of Neuroscience, Psychology and Economics*, vol 2, p 21).

Another study more clearly indicates the commercial potential of EEG scanning. A team at the Sapienza University of Rome in Italy showed 15 volunteers a 30-minute film with three commercial breaks. They reported last year that they could successfully predict which of the adverts people would remember afterwards simply from analysing their EEG traces (*Brain Topography*, vol 23, p 165).

Hidden desires

Advocates of neuromarketing believe this shows that EEG can predict what will sell in a more direct and objective way than just asking people. They also argue that you don't need to scan the brains of many people to get a representative picture of what consumers think. Small sample sizes are standard in clinical EEG studies, according to Knight, because brains react in a remarkably uniform way to the same stimulus.

Of course, marketing will always be more art than science, and even brain-scanning cannot transform it into a properly scientific enterprise. Nevertheless, companies that make consumer products, including giants such as Procter & Gamble and the Campbell Soup Company, are increasingly adding neuromarketing to their market-research armoury. According to Darren Bridger, NeuroFocus Europe's director of lab operations, just about every conceivable item is now being road-tested on human brains: adverts, movie trailers, snacks, gadgets, packaging, drinks, car designs and early-stage concepts for new products. Berns even suggests that it won't be long before neuromarketing is applied to the ultimate sales pitch: political candidates (*Nature Reviews Neuroscience*, vol 11, p 284).

If you think this all sounds like the consumer society gone horribly Orwellian, you are not alone. Berns points out that introducing neuroscience into an endeavour that exists to sell more products raises ethical issues. Will it be used to entice people into buying things they don't want, don't need and can't afford?

"It's an area that should be discussed by ethicists," says Smith. "But the concern is giving us too much credit. We're not designing products people don't want and convincing them to buy - we're helping our clients better understand what people do want, so they can address those needs. There's no 'buy button' in the brain. If people allude that there might be, it's a gross oversimplification."

Mind-reading marketers

For our own neuromarketing experiment, we teamed up with London-based NeuroFocus Europe, one of the companies that uses EEG to probe consumers' subconscious reaction to products.

In a typical test, NeuroFocus wires subjects up to a high-density array of electrodes, which gives coverage of their whole cerebral cortex. They also apply facial sensors to filter out electrical signals generated by muscle movements such as swallowing and blinking. Subjects are then exposed to the test material - TV adverts, movie trailers and so on - and their brain responses recorded. The main things NeuroFocus looks for in the EEG trace is attention, memory activation and emotional engagement. They also use eye-tracking to follow precisely where the subject is looking.

In addition, NeuroFocus looks for specific EEG patterns which the company believes betray whether or not a person will buy a product. In its early days, the company studied thousands of TV commercials looking for characteristic patterns of brain activity associated with successful and unsuccessful ads. It is these they are after. "It's not deterministic, but it gives a relative probability, given two adverts, which is more likely to change behaviour," says Michael Smith of NeuroFocus.

Finally, NeuroFocus does what it calls "deep response testing". This exploits a well-known EEG signal called P300, a spike of brain activity that occurs about 300 milliseconds after you see something new or personally meaningful. "That brain wave is interesting because it's bigger if the stimulus is very salient to you," says Smith. NeuroFocus uses this to find out if test materials have primed people's brains to certain concepts. If the P300 response to a word like "buy" is stronger just after seeing an advert, the researchers conclude that the advert is more likely to elicit a purchase.

For our experiment, we tested three alternative covers (below, left) on 19 male subjects who sometimes buy *New Scientist* at the news-stand. They saw each cover for a total of 36 seconds, and each image was followed by a series of written words to test whether the covers had primed them to the concepts "eye-catching", "intriguing" and "must-buy".

Once the testing was complete, NeuroFocus ran the data through what Smith calls its "secret sauce analysis" to produce an overall score of their neurological effectiveness. The average score for target material put through this analysis is 5 out of 10. All our covers did better than that but the winner did particularly well, with a score of 8.2. NeuroFocus recommended we use it. So we did. If you want to find out how well it sold, watch this space.

Graham Lawton is deputy editor of New Scientist.

Additional reporting by Clare Wilson

http://www.newscientist.com/article/mg20727721.300-mindreading-marketers-have-ways-of-making-you-buy.html?full=true&print=true

Hidden rocks from infant Earth hint at planet's origin

- 16:18 12 August 2010 by **Michael Marshall**

Baffin Island, portal to an ancient underworld (Image: Pete Ryan/National Geographic/Getty)

A reservoir of rock that remained intact for nearly the entire history of Earth could tell us about how our planet was built. Its chemistry hints that Earth's building blocks may have had a rough time of it, losing their skins before they could unite.

The rocks were thrown up by volcanoes in the Arctic wastes of Baffin Island and Greenland only 62 million years ago, but it seems they came from a store of rock in the mantle that formed 4.5 billion years ago – just after Earth formed.

Because the mantle slowly churns and chemically alters, this comes as a surprise. "We had almost given up hope of finding anything that had survived so long," says Matt Jackson of Boston University. But Jackson and colleagues found that their samples carry isotopes of helium, hafnium and lead in ratios that would only be found in such ancient rocks.

Rasmus Andreasen of Imperial College London is cautious about the claimed age, because radioactive decay deep in the Earth can throw results off. "The isotope evidence is intriguing, but not conclusive," he says.

If the dates are right, however, these rocks were undisturbed for almost all of Earth's history, and so hold chemical clues to our planet's origin. It is widely thought that Earth was assembled from material similar to that found in meteorites called chondrites. But Baffin's ancient rocks are different: they contain less of certain heavy elements than chondrites do.

Missing metals

Richard Carlson of the Carnegie Institution of Washington in Washington DC, who was also involved in the research, offers two possible explanations. One is that the elements missing from the Baffin rocks are dense, so they may simply have sunk deep into the Earth where we can't see them.

Alternatively, these heavy elements may have been lost before our planet came together. In the young solar system, meteoroids first gathered to form bodies called planetesimals, many of which were big enough to have volcanic activity. The missing heavy elements dissolve well in molten magma, so eruptions would have brought them to the surface. Glancing collisions between the planetesimals would then have scraped some of their crusts off, and Earth formed from what was left behind.

Meteoroids that did not coalesce into planetesimals, on the other hand, kept their heavy metals, and these were the rocks that later fell to Earth as chondrites.

Journal reference: *Nature*, DOI: 10.1038/nature09287

http://www.newscientist.com/article/dn19307-hidden-rocks-from-infant-earth-hint-at-planets-origin.html

Jupiter swallowed a super-Earth

- 11 August 2010 by **David Shiga**
- Magazine issue 2773.

The solar system's mightiest planet (Image:University of Arizona/JLP/NASA)

JUPITER might have secured its position as the solar system's mightiest planet by killing an up-and-coming rival, new simulations suggest. The work could explain why the planet has a relatively small heart, and paints a grisly picture of the early solar system, where massive, rocky "super-Earths" were snuffed out before they could grow into gas giants.

Jupiter and Saturn are thought to have begun life as rocky worlds with the mass of at least a few Earths. Their gravity then pulled in gas from their birth nebula, giving them dense atmospheres.

In this picture, all gas giants should have cores of roughly the same size. Yet spacecraft-based gravity measurements suggest Jupiter's core weighs just two to 10 Earth masses, while Saturn's comes in at 15 to 30.

New simulations by Shu Lin Li of Peking University in China, and colleagues, may explain why. They calculated what would happen when a super-Earth of 10 times the mass of our planet slammed into a gas giant. The rocky body flattened like a pancake when it hit the gas giant's atmosphere, then barrelled into the giant's core about half an hour later. The energy of the collision could have vaporised much of the core.

The rocky body flattened like a pancake when it hit the gas giant, then barrelled into its core

These vaporised heavy elements would then have mixed with the hydrogen and helium of the gas giant's atmosphere, leaving only a fraction of the gas giant's former core behind. This could explain not only why Jupiter's core is so small, but also why its atmosphere is richer in heavy elements compared with the sun, whose composition is thought to mirror that of the nebula that gave birth to the solar system's planets (arxiv.org/abs/1007.4722).

The super-Earth might have grown into a gas giant itself one day if it had not collided with Jupiter, says study co-author Douglas Lin at the University of California, Santa Cruz. "It may very well have been on its way to becoming a gas giant, but lost the race and got gobbled up," he says.

Saturn has a similar overabundance of heavy elements in its atmosphere. The team argues that this could be due to impacts by rocky objects smaller than Earth that decelerated and broke up before they could reach Saturn's core. The team's simulations suggest that this would have left the core intact, or even added to its mass as fragments rained down onto it.

"It's an interesting explanation of why you might have a variety of core masses in giant planets," says William Hubbard of the University of Arizona in Tucson. "It's a very useful contribution."

David Stevenson of the California Institute of Technology in Pasadena says he is "favourably disposed" towards the idea to explain the core size difference. But he says it is not needed to explain Jupiter's heavy-element enrichment, which, like Saturn's, could be due to numerous impacts by much smaller rocky objects.

The new work adds to the evidence that the solar system's birth was a violent and chaotic business, with perhaps five of its eight extant planets having suffered impacts by other planet-sized objects, and the rest by objects not much smaller. Giant collisions are thought to have spawned Earth's moon, blasted away the outer layers of Mercury, reshaped Mars's northern hemisphere and knocked Uranus onto its side. Smash-ups may also have led Neptune to acquire a moon (*New Scientist*, 20 March 2010, p 14) and slowed Venus's spin rate.

The new work also bolsters the idea that chance collisions play a big role in determining planet properties. Planets that form in similar conditions, like Jupiter and Saturn, can end up with very different properties as a result of such crashes, says Hubbard.

Giant collisions could explain some of the diversity seen not only in our solar system, but in planetary systems around other stars, too (see "Alien impacts"). "I think this ought to be very common," Lin says.

Alien impacts

Giant collisions around other stars could account for some of the weirdest planets seen so far.

The measured size and mass of some exoplanets indicates that they have relatively puny atmospheres but extremely massive cores. The heart of recently discovered Corot-13b, for example, seems to possess the mass of at least 140 Earths (arxiv.org/abs/1007.5481).

In 2006, Masahiro Ikoma at the Tokyo Institute of Technology in Japan, and colleagues, suggested that a smash-up between gas giants could blast away much of the giants' gas while fusing their cores. This process may have created Corot-13b, as well as another core-heavy planet called HD 149026b.

Giant collisions may have also affected other exoplanet properties, such as their orbits: planets are thought to follow circular paths at birth, but some have very elongated orbits. "People are just beginning to look at this," says Douglas Lin at the University of California, Santa Cruz.

http://www.newscientist.com/article/mg20727733.600-jupiter-swallowed-a-superearth.html

Cosmology's not broken, so why try to fix it?

- 10 August 2010 by **Andrew Pontzen** and **Hiranya Peiris**
- Magazine issue 2772.

LOOK up at the night sky and you will see just one of a vast number of possible universes that might have existed. That's a consequence of quantum mechanics, which was responsible for generating the initial ripples from which galaxies and stars later formed.

Quantum mechanics describes reality in terms of probabilities rather than specifics. This makes uncertainty an intrinsic ingredient in the standard model of cosmology - our best explanation of the origin and evolution of the universe.

For that reason, statistics is hugely important in cosmology. The standard model predicts the average properties of all possible universes, not the specific properties of our universe. If we see a discrepancy between our model and the real universe, this may be nothing more than a probabilistic fluke.

Over the past decade, cosmologists have measured in increasing detail the cosmic microwave background radiation (CMB) - the afterglow of the big bang. Its properties not only tell us about the history of the universe, but also give clues about physics at immensely high energies which experiments on Earth cannot conceivably test. So it is crucial that we interpret it correctly.

Vast numbers of scientists have pored over every detail of the CMB measurements. Some have found unexpected anomalies - the cold spot for instance, which has a much lower temperature than average, or the so-called axis of evil, which is an alignment of large-scale hot and cold patches.

According to the standard model, the chance of seeing such patterns is tiny. For example, the "correlation function anomaly", which is related to the axis of evil, has odds of just 0.05 per cent. With tiny probabilities like this floating about, some cosmologists have concluded that the standard model must be wrong and that all its predictions about the universe should be called into question.

Accepting this dramatic assessment would mean giving up the vital assumption of statistical isotropy - that the universe should, on large scales, appear the same in every direction.

In the face of such a radical revision of cherished principles, we need to be sure we are asking the right question of the data. All we've calculated so far is the chance of seeing the anomalies under our standard assumptions. The question that needs to be asked is the opposite one - what is the chance of the standard assumptions being correct, given that these anomalies exist?

Asking the first question - what is the probability of seeing what we see? - is called the frequentist approach, and it can bamboozle. Imagine, for instance, tossing a coin five times and getting five heads. The frequentist would ask: what is the probability of this happening with a normal, unweighted coin? The answer is about 3 per cent, which makes it seem as if the coin must be biased.

But now ask the revised question: how likely is it that the coin is unweighted? Imagine yourself doing the experiment with a coin from your pocket and getting five heads. What would be your reaction? Most likely

you would reject the idea that the coin is weighted. Intuitively, you know that most coins are not. Chances are what you saw was just a fluke.

This kind of feeling is not unjustified. You are using your prior knowledge of the world to inform your rational inferences. And this highlights our unease with frequentist statistics: they just don't seem flexible enough to tell us about the real world.

Ruling out hypotheses on the basis of a frequentist interpretation of results can lead to catastrophically wrong conclusions. Suppose, for instance, that aliens are collecting samples of Earth life for study. Remarkably, the first organism they beam up happens to be an airline pilot. The aliens know that only about 1 in 2000 of the human population are pilots. Adopting frequentist reasoning, they would conclude that their subject cannot be human.

Luckily there is an alternative approach which eradicates the problem: Bayesian statistics. This takes into account both information from the experiment and, crucially, any relevant real-world information. If the aliens had applied Bayes's theorem, they would have reached the correct answer: there is a 100 per cent probability that the organism is human, because no other Earth creatures are capable of piloting planes. That piece of information is vital, but is totally ignored by the frequentist analysis.

In a recent paper, we have argued that ruling out the entire cosmological model on the basis of a 0.05 per cent probability is similarly ill-advised (*Physical Review D*, DOI: 10.1103/PhysRevD.81.103008). In cosmology and elsewhere, Bayes tells us it is justifiable to be conservative in the face of statistical anomalies.

That is not to say we are desperate to preserve the status quo. But, after decades of patient data-gathering, the standard model has an enormous base of support. Bayesian statistics shows us that the anomalies in the data are insufficient on their own to motivate drastic revision. In the absence of a plausible new theory which explains all the data better, we simply can't tell whether an anomaly is just a fluke.

Getting cosmology wrong has few real-world consequences. It is perhaps more worrying that statistical blunders of the kind made by some cosmologists seem ingrained in many other sciences. We are willing to bet that erroneous leaps of statistical faith are being made in other fields. Biology, medicine, economics and environmental science all rely on statistics to make sense of their models. It's time to make Bayesian reasoning part of the standard model of science.

Blunders of the kind made by some cosmologists seem ingrained in many other sciences

Andrew Pontzen is a research fellow at Emmanuel College and the Kavli Institute for Cosmology, University of Cambridge.

Hiranya Peiris is a lecturer in cosmology at University College London

http://www.newscientist.com/article/mg20727725.700-cosmologys-not-broken-so-why-try-to-fix-it.html

Tilting solar sails will ease geostationary congestion

- 06 August 2010
- Magazine issue 2772.

SOLAR sails could relieve traffic congestion in the skies above Earth.

For a satellite to hover above a point on Earth's surface, its orbit must encircle the equator. Such geostationary orbits allow uninterrupted communication or imaging, but room for new satellites is beginning to run out. "It's a finite natural resource, a unique circle around Earth," says Colin McInnes of the University of Strathclyde in Glasgow, UK.

A satellite orbiting slightly north or south of the equator would drift relative to the ground. Now McInnes and colleague Shahid Baig have shown how to counteract that drift by fitting satellites with solar sails, which generate thrust by absorbing or reflecting sunlight.

The idea of using solar sails in this way was first proposed in 1984, but with the sails at a fixed tilt, which more detailed calculations later showed cannot eliminate the drift.

However, McInnes and Baig show that the drift can be stopped by moving the tilt periodically back and forth, so long as the satellite's orbit is no more than 50 kilometres either side of the equator (*Journal of Guidance Control and Dynamics*, DOI: 10.2514/1.46681).

http://www.newscientist.com/article/mg20727724.300-tilting-solar-sails-will-ease-geostationary-congestion.html

Chlorine study suggests moon is dry after all

- 02:08 06 August 2010 by **Maggie McKee**

The moon's interior may not be that wet after all, despite some recent studies that have suggested otherwise. A new analysis of Apollo rocks backs the old idea of a waterless world.

For decades after the Apollo astronauts touched down on the desolate lunar surface, the moon was considered to be parched. But that view began to change in 2008, when researchers found water inside tiny spheres of lunar volcanic glass at concentrations calculated to be similar to those found in some terrestrial volcanic rocks.

Now, researchers led by Zachary Sharp at the University of New Mexico in Albuquerque say measurements of chlorine in a dozen Apollo samples suggest that the moon's interior has always been extremely dry, containing 10,000 to 100,000 times less water than Earth's.

Water-loving element

Chlorine comes in two stable isotopes – ^{35}Cl and ^{37}Cl, which has two more neutrons.

Sharp's team found the heavier version is relatively more abundant in the moon samples than on Earth, suggesting the moon rocks formed in a very dry environment.

That is because hydrogen atoms contained in water readily bond with the heavy chlorine isotope to form hydrochloric acid gas, which then leaks away into space – leaving more of the lighter isotope behind.

The moon sample measurements suggest that water was present at concentrations of 180 parts per billion in the lunar mantle. That's in line with water concentrations recently measured in a lunar mineral called apatite by Francis McCubbin of the Carnegie Institution of Washington in Washington DC. "These water contents [are] very dry in comparison to Earth and Mars," he says, suggesting that previous studies that argued for Earth-like water concentrations "are likely extrapolating their data a bit too far".

What's the norm?

Those studies may have based their conclusions on very unusual lunar samples, Sharp says. He says the moon may have formed with very little water – and that no additional water from comets is necessary to explain the suite of current observations.

The moon is thought to have formed from the shrapnel of a collision between a Mars-sized object and the infant Earth 4.5 billion years ago. As the initially molten moon crystallised into rock, Sharp says minute amounts of water would have become more and more concentrated in ever-shrinking amounts of liquid magma.

This water-rich magma eventually would have erupted onto the surface because it was rich in volatiles, and the Apollo astronauts may have collected it in the form of the volcanic glass beads. "Whether these volatile-rich magmas or glasses are representative of the moon or not – that's the question," Sharp told *New Scientist*.

'Blind men and the elephant'

It's too soon to settle that question, says James Greenwood of Wesleyan University in Middletown, Connecticut, whose own isotopic studies of lunar apatite suggest that comets delivered water to the early moon. He says different regions of the moon may have different amounts of water because the roiling magma ocean that enveloped the early moon may have solidified before water from impacting comets got mixed through it evenly.

"I think what we're really doing is the case of the three blind men and the elephant – they've looked at samples and that's what they find, and we find what we find," he told *New Scientist*.

McCubbin says studying more samples, particularly those collected from areas not yet explored by Apollo or robotic missions, will be key to piecing together the history of lunar water. Water can change the force needed to bend or break rocks, and affect what minerals are formed when magma crystallises, he says: "The question of a wet or dry moon matters because water plays such an important role in geologic processes."

Journal reference: *Sciencexpress* (DOI: 10.1126/science.1192606)

http://www.newscientist.com/article/dn19270-chlorine-study-suggests-moon-is-dry-after-all.html

Green machine: Don't burn plant waste, bury it

- 16:00 10 August 2010 by **Helen Knight**

Lower carbon emissions, better crops (Image: Jeff Hutchens/Getty)

When it comes to using plant waste to mitigate climate change, most people think of turning it into ethanol or biodiesel for use as a fuel. But a new study suggests we may have more to gain by converting plant material into biochar, a type of charcoal, and burying it in farmers' fields.

Biochar is produced by heating plant waste in an oxygen-free environment, a process known as pyrolysis. This also yields syngas – a mix of carbon monoxide and hydrogen – plus a small amount of oil. Both can be burned as fuels.

Typically, up to 60 per cent of the plant's carbon ends up as biochar. When buried, this can lock the carbon away for thousands of years if necessary. The pyrolysis itself releases no carbon dioxide into the air.

Burning issue

The new study was the work of James Amonette at the Pacific Northwest National Laboratory in Richland, Washington, and colleagues. It centres on a computer model they developed to compare the carbon emissions that would be saved by converting the world's available supplies of plant waste into either biofuel or biochar.

The model showed that converting all the world's available plant waste into biofuels would cut carbon emissions by 10 per cent from today's levels. Turning it into biochar could cut emissions by up to 12 per cent – or 1.8 gigatonnes of the 15.4 gigatonnes emitted each year (*Nature Communications*, DOI: 10.1038/ncomms1053).

Carbon storage

However, the relative benefits of biochar and biofuel will vary from region to region. "It depends on the fertility of the soil in the region where you are producing the biochar, and whether you are offsetting coal or some other form of energy," Amonette says.

In regions with highly fertile soil and a high proportion of coal in their energy-generation mix, such as the American Midwest, Amonette says it may be better to convert all the available plant waste into biofuel. "But in South America, Africa, south-eastern parts of the US and most of the rest of the world on average, you're better off going with char."

Burying biochar also increases soil fertility. The Biochar Fund, based in Heverlee, Belgium, is carrying out trials of biochar with rural communities in the Democratic Republic of the Congo and southern Cameroon to improve the fertility of soil in these regions.

Midway through the second growing seasons in Cameroon with biochar in the soil, average maize yields have increased from 1.7 tonnes per hectare to 2.5 tonnes per hectare. "In many cases, we saw a spectacular boost in both biomass and grain yield because of the addition of biochar; these extremes are generally found on the poorest soils," says Laurens Rademakers, Biochar Fund's managing director.

Biochar increases the pH of acidic soil, and helps it to retain nutrients such as ammonium, calcium, magnesium, potassium and phosphorus. Some biochars are also highly porous, allowing them to trap moisture and improve the water retention of soils in dry regions, says Amonette.

http://www.newscientist.com/article/dn19289-green-machine-dont-burn-plant-waste-bury-it.html

Future on display: Long-lasting images save on power

- 17:29 12 August 2010 by **Colin Barras**

Don't step on my green light boots (Image: Daniel Saakes et al/MIT Media Lab)

Sometimes life is in the slow lane has its advantages. Eschewing the fashion for screens that can refresh hundreds of times a second, Daniel Saakes, Kevin Chiu and Tyler Hutchison from the Camera Culture group at the Massachusetts Institute of Technology, and Naoya Koizumi from the Graduate School of Media Design at Keio University in Tokyo, Japan, have built displays that changes only every few hours. The benefit, they say is unparalleled energy efficiency.

The group's Slow Display uses less than 2 watts of power to display an image on a screen with a diagonal dimension of 3.2 metres – a standard LCD screen with a diagonal dimension of just 1.3 metres can use 100 to 200 watts. Although there are alternative low-power display technologies such as electronic ink or cholesteric liquid crystal displays, they are difficult to scale without simply tiling a large number of smaller displays, says Saakes's team. Consequently, their technology is better suited for the slow-changing, always-on digital displays used in advertising or to inform road drivers about driving conditions.

The screen is coated with a light-sensitive paint that undergoes a reversible photochemical reaction when exposed to ultraviolet light, changing colour in the process. A second coat of phosphorescent paint that glows when exposed to UV light ensures the screen can be used both day and night.

The image is projected onto the display via a UV laser projector, which activates the materials coating the display. The resulting image remains legible for an hour or more after the laser is shut off. It fades away as the photochemical reaction reverses.

Fade away

To prevent the image being degraded by the UV in sunlight, a filter can be fitted to the front of the screen. The image then has to be projected from a laser mounted behind the screen.

The fading of the image is not controlled, and the team recognises that that means ghosts of old images may remain the image has been refreshed. They are investigating photosensitive compounds which react to different wavelengths of light, with the aim of creating a coating that can be turned off as well as on.

Because it is the materials coating the display surface that form the image, the technology can be applied to 3D objects. This could be put to use in an engineer's model, for example, to display virtual decals or logos.

But Saakes' team points out any such image may be short lived as it is more difficult to protect the image on a 3D object from oversaturation using a UV filter.

See more: *Beyond the touchscreen: Projecting the future*

http://www.newscientist.com/article/dn19259-future-on-display-longlasting-images-save-on-power.html

Gesture-based computing takes a serious turn

- 12 August 2010 by **MacGregor Campbell**, Los Angeles
- Magazine issue 2773.

Another day at the office, but where's the mouse and keyboard? (Image: Oblong Industries)

CALL me a creature of habit, but I approach any new computer interface with a sense of apprehension. I'm downright inept when it comes to playing video games on the Nintendo Wii: the wand controller is just too foreign to my mouse and keyboard-entrained muscles. I feel that familiar sense of unease as I stand in a nondescript brick warehouse in downtown Los Angeles.

I am at the headquarters of Oblong Industries, developers of the G-Speak gestural computing interface, and I'm about to trial its system for controlling computers through hand gestures.

I find myself surrounded by a cage of metal scaffolding, which houses the system's 16 near-infrared motion detectors, as John Underkoffler, Oblong's chief scientist, boots up the system. I'm amidst three large screens, and above me three projectors beam images onto them. A fourth overhead projector, pointing onto a white table, serves as a fourth screen. Underkoffler insists that the G-Speak is targeting hardcore number-crunchers, not gamers, but the rig looks like it would be more at home in a rock club than an office.

Underkoffler hands me a pair of black gloves with tiny reflective balls attached to the back of every digit except the pinky. The gloves help a camera follow my hands but add to the feeling that I'm about to start a performance. Yet again, Underkoffler stresses this is serious computing, before adding that: "The goal is to get rid of the gloves entirely, and we're not far from that."

First up was a basic training program. A grid of white letters hovers against a blue background on the screen in front of me. It feels playful when I'm told to form a "gun" by extending my index finger and pointing my thumb upwards. But this hand position forms the basic shape for interacting with all on-screen objects, allowing me to move a star-shaped cursor around the display. I "shoot" the gun by depressing my extended thumb and in so doing grab a letter and move it with a gesture to the table in front of me.

So far, so *Minority Report*. Having mastered the basics of point and shoot, I move on to a 3D application. Here I go from shooting to flying. On the bank of screens, a universe of regularly spaced boxes extends in all directions. To navigate, I start with the gun hand and bend my middle finger so it's at 90 degrees to my index finger. This action creates three axes on screen. Pushing up, in the direction of my thumb, moves my position up; moving my hand sideways, or forward and backward, has a similar effect. Twisting my hand rotates space.

After a bit of flailing, I gain control. I learn to target a particular box and head slowly towards it in a smooth spiral. Then suddenly the flight jerks to a halt, my gestures no longer in control. Underkoffler points out that I have let my extended fingers curve just a bit. The system tracks my fingers to within one-tenth of a millimetre in all directions - it feels surprisingly sensitive to my hand, which is used to the imprecision of a mouse. I straighten my fingers and I'm off again.

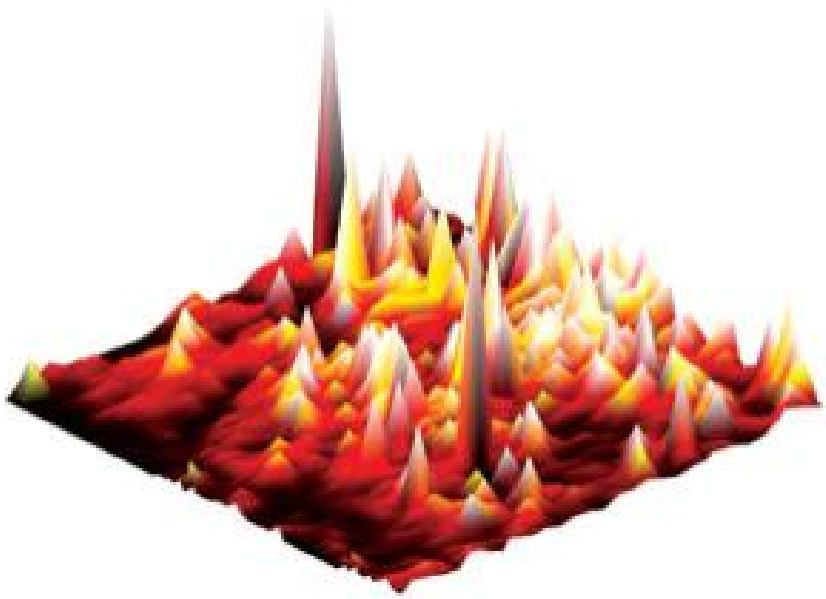
We move on through applications for video editing, photo analysis, even air-traffic control. By the end, I am really starting to appreciate that G-Speak is meant for real work: the interface allows me to sort vast amounts of on-screen information with far greater ease than I could with a mouse. Vast sweeps of my hands create rapid movements, but the system is sensitive enough to allow precise movements to be picked up too.

Will gestural computing become a mainstream technology? Perhaps, but this set-up is hardly going to fit into the standard office-worker's cubicle. Oblong promises desktop versions will soon be ready to demonstrate, though. Mastering it would take practice, but probably no more than touch-typing, and it's a lot more fun than that.

http://www.newscientist.com/article/mg20727735.400-gesturebased-computing-takes-a-serious-turn.html

Fractals promise higher-temperature superconductors

- 11 August 2010 by **Anil Ananthaswamy**
- Magazine issue 2773.



This representation of oxygen locations is observed at all scales (Image: Nicola Poccia)

SUPERCONDUCTORS could be made to work at higher temperatures than ever before, thanks to the discovery that one such material has an internal structure that behaves like a fractal. Its structure is also similar to the way the internet and some social networks are connected up.

With no electrical resistance, superconductors can conduct a large current with no energy lost as heat. This makes them extremely useful for a host of applications, from maglev trains to particle accelerators. However, most superconducting materials only work at temperatures close to absolute zero, though certain compounds containing copper and oxygen work at just over 100 kelvin.

To better understand these materials, Antonio Bianconi of the Sapienza University of Rome in Italy and colleagues studied different crystalline forms of lanthanum copper oxide. It superconducts at between 16 and 40 kelvin if it is "doped" with extra oxygen atoms, known as interstitials.

When Bianconi's team used X-ray crystallography to deduce the way the interstitials are arranged in their crystals, a pattern emerged (see picture). The pattern was the same whether the crystal structure was examined at millimetre or micrometre scales - it was behaving like a fractal (*Nature*, DOI: 10.1038/nature09260). "It's a completely unexpected result," says Bianconi.

Their analysis also revealed that the superconductor is a "scale-free" network, meaning its structure obeys the same mathematics as can be used to describe connections within the internet and some social networks. "I find it plainly mysterious," says condensed matter physicist Jan Zaanen of Leiden University in the Netherlands. "It is telling us something very deep."

The researchers also found that the greater the length scales at which the pattern persisted - or the more complete its "fractality" - the higher the maximum temperature at which the crystal could superconduct. Bianconi speculates that the scale-free distribution of the interstitial oxygen helps preserve the "quantum coherence" of electrons in the crystal. Superconductivity is thought to depend on this property, which breaks down as temperature rises.

The scale-free distribution of the oxygen in the material helps to preserve superconductivity

Engineering superconductors to increase their fractality could yield materials that work at yet higher temperatures, he adds, making it much easier to harness them for practical applications.

http://www.newscientist.com/article/mg20727733.800-fractals-promise-highertemperature-superconductors.html

Gas transistor turned on by light

- 16:09 12 August 2010 by **Duncan Graham-Rowe**

Sometimes trapped gas can be a good thing. A novel kind of transistor – the basic component of computers – uses light-controlled membranes to control the flow of gas through a network of tubes.

However, the aim of the work isn't to create a gas-based computer, says Kenneth Marshall, an expert in optical materials at the University of Rochester, New York, who developed the device with his student, Eric Glowacki.

"Think in terms of very small or micro-scale apparatus that would need gas delivery," he says, suggesting that hand-held chemical analysers or drug-delivery systems would benefit from the gas transistor. And because the device is controlled by light rather than electricity, it could also be useful for controlling the flow of flammable hydrogen or methane into fuel cells without any risk of sparking.

The membranes consist of a hard porous polycarbonate material laced with liquid crystals that are doped with a photosensitive azo dye. When illuminated with ultraviolet light, the dye molecules are kinked and the liquid crystals are randomly aligned, clogging the pores and preventing gas from passing through. But when illuminated with purple light, the dye undergoes a light-induced reaction that straightens out each molecule, forcing the liquid crystals to align and opening the pores to allow gas through.

No touch

Marshall says that other "smart" membranes for controlling the flow of gas exist, but are switched using heat or electrical signals – not ideal for use with flammable gases. Another advantage is that optical switches can be turned on and off using a distant light source and so require no interconnect to touch the membrane. Such interconnects can be tricky to make on a very small scale, and risk impeding the flow of gas through the membrane, Marshall says.

Getting the membranes to merely switch on and off like transistors is just the first stage, says Marshall. "The ultimate goal is to have the membrane act not only in a binary mode, but also in an analogue mode." This would allow the precise rate of flow of gases to be controlled, he says.

Marshall and Glowacki presented their findings at the SPIE conference in San Diego, California, earlier this month.

http://www.newscientist.com/article/dn19306-gas-transistor-turned-on-by-light.html

Building Muscle Doesn't Require Lifting Heavy Weights, Study Shows

Current gym dogma holds that to build muscle size you need to lift heavy weights. However, a new study conducted at McMaster University has shown that a similar degree of muscle building can be achieved by using lighter weights. The secret is to pump iron until you reach muscle fatigue. (Credit: iStockphoto)

ScienceDaily (Aug. 12, 2010) — Current gym dogma holds that to build muscle size you need to lift heavy weights. However, a new study conducted at McMaster University has shown that a similar degree of muscle building can be achieved by using lighter weights. The secret is to pump iron until you reach muscle fatigue.

The findings are published in *PLoS ONE.*

"Rather than grunting and straining to lift heavy weights, you can grab something much lighter but you have to lift it until you can't lift it anymore," says Stuart Phillips, associate professor of kinesiology at McMaster University. "We're convinced that growing muscle means stimulating your muscle to make new muscle proteins, a process in the body that over time accumulates into bigger muscles."

Phillips praised lead author and senior Ph.D. student Nicholas Burd for masterminding the project that showed it's really not the weight that you lift but the fact that you get muscular fatigue that's the critical point in building muscle. The study used light weights that represented a percentage of what the subjects could lift. The heavier weights were set to 90% of a person's best lift and the light weights at a mere 30% of what people could lift. "It's a very light weight," says Phillips noting that the 90-80% range is usually something people can lift from 5-10 times before fatigue sets in. At 30%, Burd reported that subjects could lift that weight at least 24 times before they felt fatigue.

"We're excited to see where this new paradigm will lead," says Phillips, adding that these new data have practical significance for gym enthusiasts but more importantly for people with compromised skeletal muscle

mass, such as the elderly, patients with cancer, or those who are recovering from trauma, surgery or even stroke.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **McMaster University**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Burd et al. **Low-Load High Volume Resistance Exercise Stimulates Muscle Protein Synthesis More Than High-Load Low Volume Resistance Exercise in Young Men**. *PLoS ONE*, 2010; 5 (8): e12033 DOI: 10.1371/journal.pone.0012033

http://www.sciencedaily.com/releases/2010/08/100811125943.htm

Texas Petrochemical Emissions Down, but Still Underestimated, Says Study

While petrochemical air pollution in Houston is decreasing, industry there still is underestimating the amounts of reactive chemicals released into the air that lead to ground-level ozone problems, according to a new study by a team of scientists at the Cooperative Institute for Research in Environmental Sciences, a joint institute of the University of Colorado at Boulder and the National Oceanic and Atmospheric Administration. Image of WD-P3 on the tarmac in Houston courtesy of CIRES. (Credit: Bill Dube/NOAA)

ScienceDaily (Aug. 11, 2010) — A thick blanket of yellow haze hovering over Houston as a result of chemical pollution produced by manufacturing petroleum products may be getting a little bit thinner, according to a new study.

But the new findings -- which have implications for petrochemical-producing cities around the world -- come with a catch, says a team of scientists from the Cooperative Institute for Research in Environmental Sciences, or CIRES, a joint institute of the University of Colorado at Boulder and the National Oceanic and Atmospheric Administration.

The problem is that industry still significantly underestimates the amounts of reactive chemicals being released into the air, according to airplane measurements made by the research team as part of the study. Inaccuracies in the reporting of emissions pose big challenges for the reduction and regulation of emissions

coming from petrochemical plants. The emissions are important to monitor, because some chemicals released from the plants react to form ground-level ozone that can be harmful to human health and agricultural crops.

"Emissions may have decreased some, but there's still a long way to go," said study author Joost de Gouw, a CIRES atmospheric scientist. "And the emission inventories by industry were not any better in 2006 than they were in 2000."

States that regularly suffer from ozone problems like Texas are required by the federal government to scientifically model what happens during air pollution episodes and develop plans for mitigation. For that to happen effectively, modelers need good inventories, says the research team."Initial inventories are not based on measurements. They're based on estimates," said de Gouw. "When you go back to verify those estimates, we find they're not very accurate."

To check on those estimates, lead study author Rebecca Washenfelder of NOAA's Earth System Research Laboratory and CIRES, along with de Gouw, took to the plumes in an aircraft, the NOAA WP-3D, outfitted with an array of air quality measuring instruments. The plane flew through emissions over Houston as part of the second Texas Air Quality Study in 2006, sampling air for signs of ingredients of the chemical reaction that makes ozone, including nitrogen oxides and reactive hydrocarbons.Washenfelder, de Gouw and their study colleagues compared these measurements with data taken during similar flyovers from the first Texas Air Quality Study in 2000 and another flight in 2002. They then compared those measurements against emissions inventories for each year. In all cases, the industry-reported inventories -- which are supplied to the U.S. Environmental Protection Agency -- didn't agree with the measured amounts of pollutants.

The conflicting data is likely a problem of estimation and general industry practice. "There are tens of thousands of valves and fittings installed throughout the plants in most cases with an assumed -- not measured -- leak rate for each," Washenfelder said.But industry is taking steps to lessen ozone-causing emissions, and repairs to petrochemical plants may have contributed to recent emission declines. Washenfelder and de Gouw found that the concentrations of ethene and propene -- which both contribute to ozone formation -- dropped by 52 percent and 48 percent respectively between 2000 and 2006.The two scientists see the study as a wake-up call for emissions monitoring.

"There are a lot of discussions with the petrochemical industry on how to measure these things instead of relying on estimates," said de Gouw. "I think the No. 1 issue here is awareness. As soon as industry is aware that there could be emissions problems down the road, they can figure out how to fix them at lower cost."

The study been accepted for publication in the *Journal of Geophysical Research -- Atmospheres,* a publication of the American Geophysical Union. Funding for the project came from NOAA Air Quality, NOAA Climate Research and Modeling Program, the Texas Commission on Environmental Quality and a National Research Council Postdoctoral Fellowship.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Colorado at Boulder**.

http://www.sciencedaily.com/releases/2010/08/100811135043.htm

High Malaria Transmission Areas Remain a Problem for Elimination

ScienceDaily (Aug. 12, 2010) — Current tools for combating malaria, such as artemisinin-combination therapy and increasing coverage of long-lasting insecticide bednets can result in major reductions in *Plasmodium falciparum* malaria transmission and the associated disease burden in Africa. Furthermore, if such interventions can be rolled out to achieve a comprehensive and sustained intervention program, a parasite prevalence threshold of 1% may be achievable in areas where there is a low- to moderate transmission of malaria and where mosquitoes mainly rest indoors.

These are the findings from a modeling study by Jamie Griffin and colleagues from Imperial College London and the London School of Hygiene and Tropical Medicine, published in *PLoS Medicine*.

The authors reached these conclusions by developing a mathematical simulation model for *P. falciparum* transmission in Africa, which incorporated three major types of mosquito, parasite prevalence data in 34 areas of Africa with differing *P. falciparum* malaria transmission levels, and the effect of switching to artemisinin-combination therapy and increasing coverage of long-lasting insecticide treated bednets. Then the authors explored the impact on transmission of continued roll-out of long-lasting insecticide treated bednets, additional rounds of indoor residual spraying, mass screening and treatment and a future vaccine in six representative settings with varying transmission intensity with the aim of reaching a realistic target of 80% coverage. The model predicted some success in low and moderate transmission settings but in high-transmission areas and those in which mosquitoes are mainly outdoor-resting, additional new tools that target outdoor-biting mosquitoes and substantial social improvements will be required as higher levels of intervention coverage are unrealistic.

The authors say, "Our model is necessarily a simplification of the more complex dynamics underlying malaria transmission and control, so numerical results should be interpreted more as providing intuitive insight into potential scenarios than as firm predictions of what might happen in a given setting."

This work was funded by the Bill & Melinda Gates Vaccine Modeling Initiative, the UK Medical Research Council, Microsoft Research, and the TransMalariaBloc European Commission FP7 Collaborative project (HEALTH-F3-2008-223736). TDH is funded by an Imperial College Junior Research Fellowship.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Public Library of Science**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Griffin JT, Hollingsworth TD, Okell LC, Churcher TS, White M, et al. **Reducing Plasmodium falciparum Malaria Transmission in Africa: A Model-Based Evaluation of Intervention Strategies**. *PLoS Medicine*, 2010; 7 (8): e1000324 DOI: 10.1371/journal.pmed.1000324

http://www.sciencedaily.com/releases/2010/08/100810203453.htm

Study Finds Similar Personality Types in Male and Female Domestic Violence Perpetrators

ScienceDaily (Aug. 10, 2010) — New research published in the August edition of the American Psychological Association's *Journal of Abnormal Psychology,* is providing a better picture of the roles played by gender, personality and mental illness in domestic violence.

"Intimate partner violence is a major public health concern," says the study's lead author Zach Walsh, assistant professor of psychology at the University of British Columbia's (UBC) Okanagan campus. "Examining subtypes of perpetrators is an important way of learning more about why people are violent in close relationships. Understanding why different people are violent may be crucial for developing new ways to reduce violence in relationships. "

Walsh and colleagues Marc Swogger (University of Rochester), Brian O'Connor (UBC), Yael Schonbrun (Brown University), Tracie Shea (Brown University), and Gregory Stuart (University of Tennessee-Knoxville) analyzed data drawn from the MacArthur Violence Risk Assessment Study to examine normal personality, psychopathic characteristics, and mental illness among 567 civil psychiatric patients, including 138 women and 93 men with histories of domestic violence.

"Although both men and women engage in substantial levels of domestic violence, fewer studies have examined female perpetrators," says Walsh. "These new findings are among the first to highlight similarities between subtypes of domestically violent men and women."

Prior studies of domestically violent men have found that perpetrators can be categorized into three groups. The study provides preliminary evidence that the following three subtypes also exist among female perpetrators:

- Antisocial perpetrators are often violent outside the relationship and have high levels of psychopathic personality traits
- Dysphoric perpetrators may have high levels of anxiety, depression and other forms of mental illness
- Low Pathology perpetrators have generally normal personalities and are rarely violent outside of intimate relationships

The findings also suggest that subtypes from studies of domestic violence perpetrators in the community can be applied to perpetration by psychiatric patients. Learning more about psychiatric patients who perpetrate domestic violence is important, as they engage in higher levels of domestic violence than do the general population.

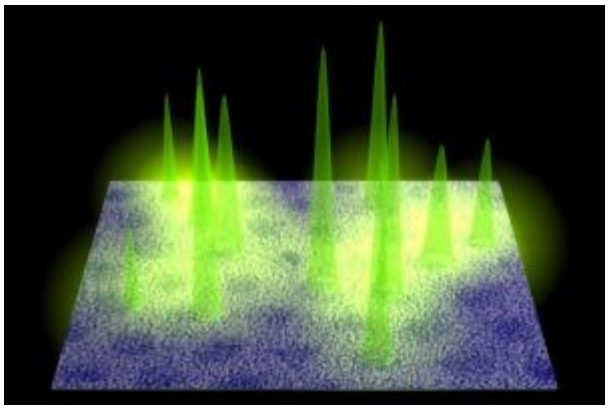
Walsh encourages caution in generalizing from psychiatric patients to the larger community, and is currently working with his students to examine these subtypes among other group

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of British Columbia**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/08/100810203507.htm

Breakthrough in Blinking Molecules Phenomenon



Fluorescence intensity measured by a single-molecule microscope sees sharp peaks at quantum dot locations. (Credit: Boldizsár Jankó / University of Notre Dame)

ScienceDaily (Aug. 12, 2010) — A new paper by University of Notre Dame physicist Boldizsár Jankó and colleagues offers an important new understanding of an enduring mystery in chemical physics.

More than a century ago, at the dawn of modern quantum mechanics, the Noble Prize-winning physicist Neils Bohr predicted so-called "quantum jumps." He predicted that these jumps would be due to electrons making transitions between discrete energy levels of individual atoms and molecules. Although controversial in Bohr's time, such quantum jumps were experimentally observed, and his prediction verified, in the 1980s. More recently, with the development of single molecule imaging techniques in the early 1990s, it has been possible to observe similar jumps in individual molecules.

Experimentally, these quantum jumps translate to discrete interruptions of the continuous emission from single molecules, revealing a phenomenon known as fluorescent intermittency or "blinking."

However, while certain instances of blinking can be directly ascribed to Bohr's original quantum jumps, many more cases exist where the observed fluorescence intermittency does not follow his predictions. Specifically, in systems as diverse as fluorescent proteins, single molecules and light harvesting complexes, single organic fluorophores, and, most recently, individual inorganic nanostructures, clear deviations from Bohr's predictions occur.

As a consequence, virtually all known fluorophores, including fluorescent quantum dots, rods and wires, exhibit unexplainable episodes of intermittent blinking in their emission.

The prevailing wisdom in the field of quantum mechanics was that the on and off blinking episodes were not correlated. However, at a 2007 conference on the phenomenon sponsored by Notre Dame's Institute for Theoretical Sciences, which Jankó directs, Fernando Stefani of the University of Buenos Aires presented research suggesting that there was, in fact, correlation between these on and off events. No theoretical model available at that time was able to explain these correlations.

In a 2008 *Nature Physics* paper, Jankó and a group of researchers that included Notre Dame chemistry professor Ken Kuno, physics visiting assistant professor Pavel Frantsuzov and Nobel Laureate Rudolph

Marcus suggested that the on- and off-time intervals of intermittent nanocrystal quantum dots follow universal power law distributions. The discovery provided Jankó and other researchers in the field with the first hints for developing a deeper insight into the physical mechanism behind the vast range of on- and off-times in the intermittency.

In a new paper appearing in the journal *Nano Letters*, Jankó, Frantsuzov and Notre Dame graduate student Sándor Volkán-Kascó reveal that they have developed a model for the blinking phenomena that confirms what Stefani observed experimentally. The finding is important confirmation that strong correlation exists between the on and off phenomenon.

If the blinking process could be controlled, quantum dots could, for example, provide better, more stable imaging of cancer cells; provide researcher with real-time images of a viral infection, such as HIV, within a cell; lead to the development of a new generation of brighter display screens for computers, cell phones and other electronic applications; and even improved lighting fixtures for homes and offices.

The *Nano Letters* paper represents another important step in understanding the origins of the blinking phenomenon and identifying ways to control the process.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Notre Dame**. The original article was written by William G. Gilroy, Assistant Director, Office of Public Relations.

Journal Reference:

1. Sándor Volkán-Kacsó, Pavel A. Frantsuzov, Boldizsár Jankó. **Correlations between Subsequent Blinking Events in Single Quantum Dots**. *Nano Letters*, 2010: 100722142755098 DOI: 10.1021/nl100253r

http://www.sciencedaily.com/releases/2010/08/100811162356.htm

Potential Treatment for Pulmonary Hypertension Discovered

ScienceDaily (Aug. 11, 2010) — Researchers in the Faculty of Medicine & Dentistry at the University of Alberta are one step closer to a treatment for pulmonary arterial hypertension, a potentially deadly disease.

Pulmonary arterial hypertension, which is high blood pressure in the lungs, currently has only a few treatment options, but most cases lead to premature death. It is caused by a cancer-like excessive growth of cells in the wall of the lung blood vessels. It causes the lumen, the path where blood travels, to constrict putting pressure on the right ventricle of the heart which eventually leads to heart failure.

Evangelos Michelakis, his graduate student Gopinath Sutendra and a group of collaborators have found that this excessive cell growth can be reversed by targeting the mitochondria of the cell, which control metabolism of the cell and initiate cell death.

By using dichloroacetate (DCA) or Trimetazidine (TMZ), mitochondria targeted drugs, the activity of the mitochondria increases which helps induce cell death and regresses pulmonary hypertension in an animal model, says Sutendra.

Current therapies only look at dilating the constricted vessels rather than regression, so this is a very exciting advancement for the lab.

"In the pulmonary hypertension field they're really looking for new therapies to regress the disease, it might be the wave of the future," said Sutendra. "The other thing that is really exciting is that TMZ and DCA have been used clinically in patients so it's something that can be used right away in these patients."

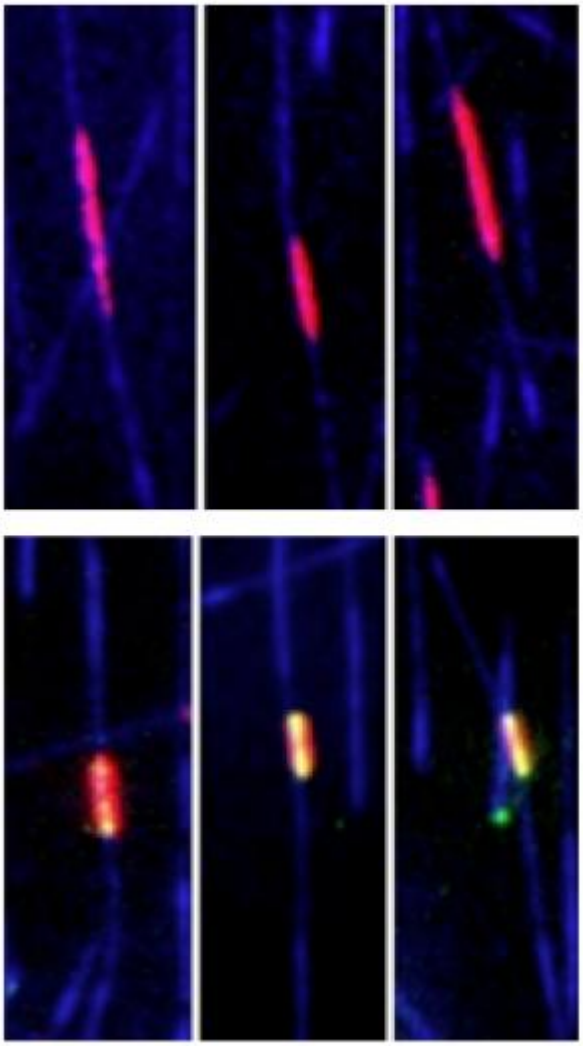
Clinical trials are expected to be the next step. Michelakis is currently working with a college in the United Kingdom to have patients with pulmonary hypertension take DCA.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Alberta**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/08/100811141106.htm

Constant Overlap: Scientists Identify Molecular Machinery That Maintains Important Feature of Cell's Spindle



If both PRC1 and kinesin-4 are present (top image from video), microtubules (blue) grow only until their overlap (red/yellow) reaches a certain size, which then remains constant. But if only PRC1 is present, microtubule growth is not inhibited in the overlap region, which becomes bigger and bigger (second image from video). (Credit: EMBL/P. Bieling)

ScienceDaily (Aug. 12, 2010) — During cell division, microtubules emanating from each of the spindle poles meet and overlap in the spindle's mid zone. Scientists at the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany, have uncovered the molecular mechanism that determines the extent of this overlap.

In a study published in *Cell*, they were able to reconstruct such anti-parallel microtubule overlaps in vitro, and identify two proteins which are sufficient to control the formation and size of this important spindle feature.

Thomas Surrey and his group at EMBL found that one protein, PRC1, bundles together microtubules coming from opposite ends of the cell, attaching them to each other. It then recruits a second protein, a molecular motor from the kinesin-4 subfamily, increasing its concentration in the spindle mid zone. This motor walks along the overlapping microtubules like an officer on patrol, until it reaches one of the ends. When enough kinesin-4 molecules reach the end of the overlap, they inhibit the growth of microtubules there, thus keeping the overlap size constant without affecting microtubules elsewhere in the cell.

The spindle mid zone plays an important role not only in helping to align the chromosomes in metaphase, but also in the final stages of cell division, when it drives the physical separation of the two daughter-cells. But between these two stages, the two ends of the spindle must move away from each other, to drag half the genetic material to each side of the dividing cell. At this point, if PRC1 and kinesin-4 had stopped microtubule growth permanently in the central part of the spindle, the overlap would become smaller and smaller, until eventually the spindle itself would collapse, jeopardising cell division.

But Surrey and colleagues found that PRC1 and kinesin-4 control the overlap size in an adaptive manner. As the spindle stretches and the overlap between microtubules becomes smaller, the scientists posit, the inhibitory effect of kinesin-4 diminishes, allowing the microtubule ends to grow.

"Our findings show how molecules millionths of millimetres small can control the size of a structure about a thousand times larger than themselves," Surrey concludes: "they help us to understand the fundamentals of cell division."

Story Source:

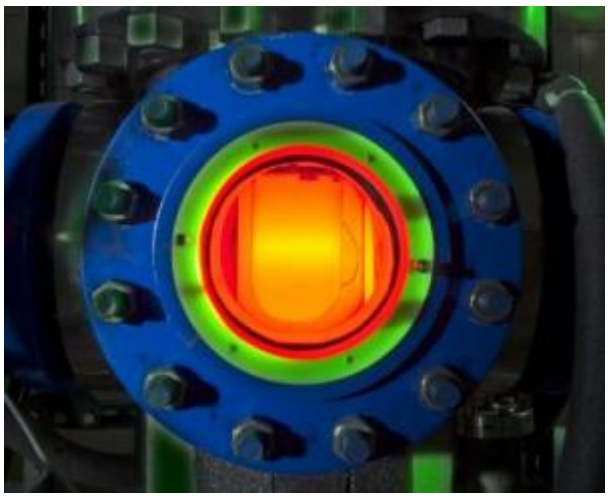
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **European Molecular Biology Laboratory (EMBL)**.

Journal Reference:

1. Bieling, P., Telley, I.A. & Surrey, T. **A Minimal Midzone Protein Module Controls Formation and Length of Antiparallel Microtubule Overlaps**. *Cell*, 2010; 142 (3): 420 DOI: 10.1016/j.cell.2010.06.033

http://www.sciencedaily.com/releases/2010/08/100806080215.htm

Dark-Matter Search Plunges Physicists to New Depths



Pictured here is the 1-liter bubble chamber during testing at MINOS Hall, 350 feet underneath Fermi National Accelerator Laboratory. Physicists installed a similar but larger bubble chamber for detecting dark matter this summer in a laboratory more than a mile underground in Sudbury, Canada. (Credit: Reidar Hahn/Fermilab)

ScienceDaily (Aug. 11, 2010) — This month physicist Juan Collar and his associates are taking their attempt to unmask the secret identity of dark matter into a Canadian mine more than a mile underground.

The team is deploying a 4-kilogram bubble chamber at SNOLab, which is part of the Sudbury Neutrino Observatory in Ontario, Canada. A second 60-kilogram chamber will follow later this year. Scientists anticipate that dark matter particles will leave bubbles in their tracks when passing through the liquid in one of these chambers.

Dark matter accounts for nearly 90 percent of all matter in the universe. Although invisible to telescopes, scientists can observe the gravitational influence that dark matter exerts over galaxies. "There is a lot more mass than literally meets the eye," said Collar, Associate Professor in Physics at the University of Chicago. "When you look at the matter budget of the universe, we have a big void there that we can't explain."

Likely suspects for what constitutes dark matter include Weakly Interacting Massive Particles (WIMPS) and axions. Theorists originally proposed the existence of both these groups of subatomic particles to address issues unrelated to dark matter. "These seem to be perfect to explain all of these observations that give us this evidence for dark matter, and that makes them very appealing," Collar said.

SNOLab will be the most ambitious in a series of underground locations where Collar and his colleagues have searched for dark matter. In 2004, they established the Chicagoland Observatory for Underground Particle Physics (COUPP) at Fermi National Accelerator Laboratory.

"We started with a detector the size of a test tube and now have increased the mass by a factor of more than a thousand," said Fermilab physicist Andrew Sonnenschein. "It's exciting to see the first bubble chamber being sent off to SNOLab, because the low level of interference we can expect from the cosmic rays there will make our search for dark matter enormously more sensitive."

The COUPP collaboration consists of scientists from UChicago, Fermilab and Indiana University at South Bend. In 2008 the collaboration released its first results that established an old technology of particle physics -- the bubble chamber -- as a potential dark-matter detector.

COUPP extends to the city of Chicago's flood-control infrastructure, called the Tunnel and Reservoir Project. The city has granted COUPP scientists access to the tunnels, 330 feet underground, to test prototypes of their

instruments. The collaboration also tested instruments in a chamber 350 feet below Fermilab, and in a sub-basement of the Laboratory for Astrophysics and Space Research on the UChicago campus.

Collar continually seeks underground venues for his research in order to screen out false signals from various natural radiation sources, including cosmic rays from deep space. "It's an interesting lifestyle," Collar said.

The troublesome underground radiation sources consist of charged particles that lose energy as they traverse through a mile or more of rock. But rock has no impact on particles that interact weakly with matter, such as WIMPS, thus the move to Sudbury.

"SNOLab is a very special, spectacular place, because the infrastructure that the Canadians have developed down there is nothing short of amazing," Collar said. Even though SNOLab sits atop a working nickel mine, conditions there are pristinely antiseptic.

"As you walk in, you have to shower to remove any trace of dust," he said. "It's a clean-room atmosphere, meaning that there's essentially no specks of dust anywhere. We have to worry about such things, sources of radiation associated with dust."

Collar also is a member of the Coherent Germanium Neutrino Technology (CoGeNT) collaboration, which operates a detector that sits nearly half a mile deep at the Soudan Underground Mine State Park in northern Minnesota. The 60-kilogram detector that Collar and colleagues will install at SNOLab later this year, meanwhile, undergoes testing in a tunnel 350 feet beneath Fermilab.

Linking the two sites is an invisible beam of neutrinos that stretches 450 miles from Fermi to Soudan. The beam is part of the Main Injector Neutrino Oscillation Search (MINOS), a particle-physics experiment that is unrelated to the search for dark matter.

The two detectors rely on entirely different techniques. CoGeNT uses a new type of germanium detector that targets the detection of light WIMPS.

"Most of us have been concentrating on intermediate-mass WIMPS for decades," Collar said. "In the last few years the theoreticians have been telling us more and more, look, under these other sets of assumptions, it could be a lighter WIMP. This device is actually the first of its kind in the sense that it's targeted specifically for light WIMPS. We're seeing interesting things with it that we don't fully understand yet."

Collar estimates that it'll take a decade or more for physicists to become completely convinced that they've seen dark-matter particles.

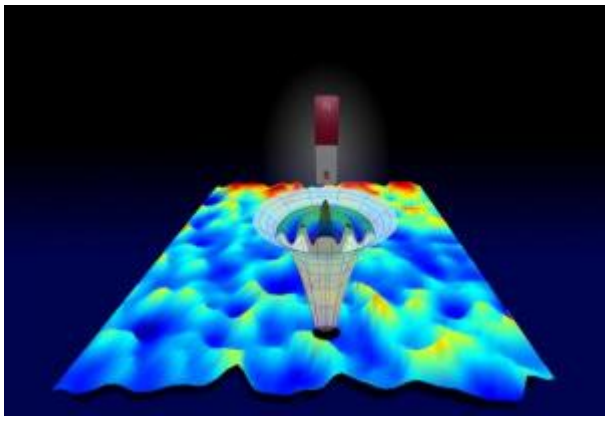
"It's going to take a lot of information from very many different points of view and entirely independent techniques," he said. "One day we'll figure it out."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Chicago**.

http://www.sciencedaily.com/releases/2010/08/100811105246.htm

Scientists Achieve Highest-Resolution MRI of the Inside of a Magnet



Researchers at Ohio State University have developed a new type of magnetic resonance that can see inside magnetic materials. Here, slight variations in the structure of a thin magnetic film are evident as variations in ferromagnetic resonance frequency, represented by changes in color. Above the film is a representation of a polarized magnetic tip that scans the material. (Credit: Image courtesy of Ohio State University.)

ScienceDaily (Aug. 11, 2010) — In a development that holds potential for both data storage and biomedical imaging, Ohio State University researchers have used a new technique to obtain the highest-ever resolution MRI scan of the inside of a magnet.

Chris Hammel, Ohio Eminent Scholar in Experimental Physics, and his colleagues took a tiny magnetic disk -- measuring only 2 micrometers (millionths of a meter) across and 40 nanometers (billionths of a meter) thick -- and were able to obtain magnetic resonance images its interior.

The resulting image -- with each "pixel" one tenth the size of the disk itself -- is the highest-resolution image ever taken of the magnetic fields and interactions inside of a magnet.

Why look inside magnets? Because studying the material's behavior at these tiny scales is key to incorporating them into computer chips and other electronic devices.

The researchers report their findings in the August 12 issue of the journal *Nature*.

In 2008, Hammel's team debuted a new kind of high-resolution scanning system that combines three different kinds of technology: MRI, ferromagnetic resonance, and atomic force microscopy.

Ferromagnets -- the type of magnet used in this study -- are magnets made of ferrous metal such as iron. Common household refrigerator magnets are ferromagnets.

Because ferromagnets retain a particular polarization once magnetized, they are already essential components in today's computers and other electronics, where they provide data storage alongside computer chips. But smaller magnets built directly into a computer chip could do even more, Hammel explained.

"We know that shrinking these magnets to the nanoscale and building them directly inside electronics would enable these devices to do more, and with less power consumption," Hammel said. "But a key barrier has always been the difficulty of imaging and characterizing nanomagnets."

Typical MRI machines work by inducing a magnetic field inside non-magnetic objects, such as the body. Since ferromagnets are already magnetic, conventional MRI can't see inside them.

The combination technique that the Ohio State researchers invented is called "scanned probe ferromagnetic resonance imaging," or scanned probe FMRI, and it involves detecting a magnetic signal using a tiny silicon bar with an even tinier magnetic probe on its tip.

In *Nature*, they report a successful demonstration of the technique, as they imaged the inside of the magnetic disk 0.2 micrometers (200 nanometers) at a time. They used a thin film of a commercially available nickel-iron magnetic alloy called Permalloy for the disk.

"In essence, we were able to conduct ferromagnetic resonance measurements on a small fraction of the disk, then move our probe over a little bit and do magnetic resonance there, and so on," explained Denis Pelekhov, director of the ENCOMM NanoSystems Laboratory at Ohio State. "Using these results, we could see how the magnetic properties vary inside the disk."

Experts suspect that computer chips equipped with tiny magnets might one day provide high-density data storage. Computers with magnets in their central processing units (CPUs) would never have to boot up. The entire computer would be contained inside the CPU, making such devices even smaller and less power-hungry as well.

Hammel believes that the technique could one day be useful tool in biomedical research labs. Researchers could use it to study tissue samples of the plaques that form in brain tissues and arteries, and perhaps develop better ways of detecting them in the body. Knowing how these plaques form could advance studies of many diseases, including Alzheimer's and atherosclerosis.

Hammel and Pelekhov's co-authors on the paper include Inhee Lee, Yuri Obukhov, Gang Xiang,, Adam Hauser, Fengyuan Yang, and Palash Banerjee, all of the Department of Physics at Ohio State.

This research was funded by the Department of Energy.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Ohio State University**. The original article was written by Pam Frost Gorder.

Journal Reference:

1. Lee et al. **Nanoscale scanning probe ferromagnetic resonance imaging using localized modes**. *Nature*, 2010; 466 (7308): 845 DOI: 10.1038/nature09279

http://www.sciencedaily.com/releases/2010/08/100811135041.htm

Proteins Linked With Alzheimer's, Other Neurodegenerative Diseases Found to Clump in Normal Aging

ScienceDaily (Aug. 11, 2010) — In neurodegenerative diseases, clumps of insoluble proteins appear in patients' brains. These aggregates contain proteins that are unique to each disease, such as amyloid beta in Alzheimer's disease, but they are intertwined with small amounts of many other insoluble proteins that are normally present in a soluble form in healthy young individuals. For years, these other proteins were thought to be accidental inclusions in the aggregates, much as a sea turtle might be caught in a net of fish.

Now, in a surprising new finding, researchers at the University of California, San Francisco, report that many of the proteins present as minor components of disease aggregates actually clump together as a normal part of aging in healthy individuals.

The discovery, in the *C. elegans* roundworm, refutes a widespread belief that the presence of insoluble proteins is unique to degenerative disease and that the main proteins traditionally associated with each disease (like amyloid beta in Alzheimer's disease) are the only ones that could have an impact.

The research showed that a variety of common soluble proteins, such as those responsible for growth, can become insoluble and form aggregates in animals as they age. Moreover, the research demonstrated that gene manipulations that extend *C. elegans* lifespan prevent these common proteins from clumping.

The findings appear in the August 11, 2010 issue of the journal *PLoS Biology*.

"If you take people with Alzheimer's and look at their aggregates, there are many other proteins in the clump that no one has paid much attention to," said UCSF biochemist Cynthia Kenyon, PhD, director of the Larry L. Hillblom Center for the Biology of Aging at UCSF and senior author of the paper. "It turns out that about half of these proteins are aggregating proteins that become insoluble as a normal part of aging."

The team found that, in the presence of proteins specific to Huntington's disease, these other insoluble proteins actually sped up the course of the disease, indicating that they could be fundamental to its progression.

The findings indicate that widespread protein insolubility and aggregation is an inherent part of aging and that it may influence both lifespan and neurodegenerative disease, Kenyon said.

The presence of insoluble protein aggregates has long been recognized as a hallmark of such neurodegenerative diseases as Alzheimer's, Huntington's and amyotrophic lateral sclerosis (ALS). The team, led by first author Della C. David, PhD, a postdoctoral scholar in the UCSF Department of Biochemistry and Biophysics, asked a simple question that had never been addressed: Do normal proteins form insoluble clumps when normal, healthy individuals age?

They identified roughly 700 proteins in a *C. elegans* worm that become insoluble as the animal ages. These insoluble proteins are highly over-represented in the aggregates found in human neurodegeneration, the researchers wrote in their paper. They found that many of the proteins that became insoluble were already known to accelerate the aging process and to influence the aggregation of the major disease proteins. Yet even in the healthy aging worms, these proteins had a propensity for clumping and forming hard, rocklike structures.

The team found that this aggregation was significantly delayed or even halted by reducing insulin and IGF-1 hormone activity, whose reduction is known to extend animal lifespan and to delay the progression of Huntington's and Alzheimer's disease in animal models of neurodegenerative diseases.

While there are indisputable differences between worms and men, the roundworm *C. elegans* (Caenorhabditis elegans) often has led the way in advancing our understanding of human biology, notably in such areas as the mechanism of cell death, insulin pathways, the genes involved in cancer, and aging.

Some of those advances have originated in Kenyon's lab, including the discovery that blocking the activity of a single gene in *C. elegans* doubled the animal's lifespan. The gene, known as daf-2, encodes a receptor for insulin as well as for IGF-1. The same or related hormone pathways have since been shown to affect lifespan in fruit flies and mice, and are thought to influence lifespan in humans.

Co-authors on the paper include Michael P. Cary, also in the UCSF Department of Biochemistry and Biophysics; Noah Ollikainen, in the UCSF Graduate Program in Biological and Medical Informatics; and Jonathan C. Trinidad and Alma L. Burlingame, both with the Mass Spectrometry Facility in the UCSF Department of Pharmaceutical Chemistry.

The research was supported by fellowships from the Swiss National Foundation and the Larry L. Hillblom Foundation. The work was further supported by the UCSF Program for Breakthrough Biomedical Research and the National Institutes of Health. The authors have declared that no competing interests exist.

Story Source:

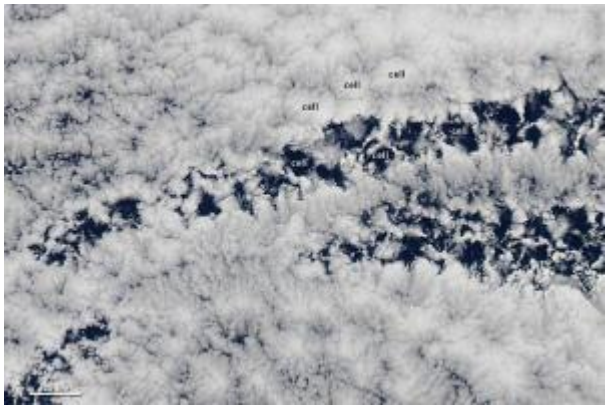
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - San Francisco**.

Journal Reference:

1. David DC, Ollikainen N, Trinidad JC, Cary MP, Burlingame AL, et al. **Widespread Protein Aggregation as an Inherent Part of Aging in C. elegans**. *PLoS Biology*, 2010; 8 (8): e1000450 DOI: 10.1371/journal.pbio.1000450

http://www.sciencedaily.com/releases/2010/08/100810203551.htm

Rain Contributes to Cycling Patterns of Clouds: Researchers Demonstrate How Honeycomb Clouds Exhibit Self-Organization



Marine stratocumulus clouds have open cells (sky in the middle) and closed cells (cloudy in the middle). (Credit: Jeff Schmaltz, NASA / Earth Observatory)

ScienceDaily (Aug. 11, 2010) — Like shifting sand dunes, some clouds disappear in one place and reappear in another. New research published in *Nature* shows why: Rain causes air to move vertically, which breaks down and builds up cloud walls. The air movement forms patterns in low clouds that remain cohesive structures even while appearing to shift about the sky, due to a principle called self-organization.

These clouds, called open-cell clouds that look like honeycombs, cover much of the open ocean. Understanding how their patterns evolve will eventually help scientists build better models for predicting climate change. This is the first time researchers have shown the patterns cycle regularly and why.

"The pattern of the clouds affects how much of the sun's energy gets reflected back into space," said atmospheric scientist Hailong Wang of the Department of Energy's Pacific Northwest National Laboratory, a coauthor on the study led by physicist Graham Feingold at the National Oceanic and Atmospheric Administration.

"We've teased out the fundamental reasons why the open-cell clouds oscillate. Being able to simulate these clouds in computer models, we gain more insights into the physics behind the phenomenon. This will help us to better interpret measurements in the real atmosphere and represent these clouds in climate models," Wang said.

In addition, this is the first time researchers have shown that open-cell clouds follow the principles of self-organizing systems -- they spontaneously form dynamic, coherent structures that tend to repair themselves and resist change. Such clouds join other self-organizing networks such as flocks of birds, shifting sand dunes or bubbles in boiling water.

Convection Imperfection

Open-cell clouds are low, flat clouds that look like a quilt to someone looking down from an airplane. The quilt patches are frames of cloud that are clear in the middle, similar to a honeycomb. These honeycomb

clouds develop from atmospheric convection, which is air movement caused by warm air rising and cold air falling.

The white parts of the honeycomb clouds reflect sunshine back into space, but the open spaces let energy through to warm up the planet. Because these clouds cover a lot of the ocean, climate scientists need to incorporate the clouds into computer models.

The simplest explanation for their appearance is what is known as Rayleigh-Benard convection. This classic form of convection can be seen between two horizontal, flat plates separated by a thin liquid layer: Heat up the bottom and warm liquid rises, pushing cold liquid near the top downward. The updrafts and downdrafts mold the liquid into vertical walls. If the bottom heats uniformly, the flow causes the top surface to break up into hexagonal cells, looking like a honeycomb. A honeycomb structure, it turns out, is one of the most effective way to transfer heat.

This occurs on a large scale in our atmosphere from the surface up to a couple kilometers (less than two miles). But the earth's ocean is not a uniform surface and it doesn't warm the atmosphere evenly from below. That's one reason why open-cell clouds do not organize into perfect hexagons.

Also, the atmosphere is much more complex than a laboratory experiment. Other factors interfere with this type of convection such as aerosols, tiny particles of dirt around which cloud drops form. The number of aerosols determines the size of cloud drops and whether to form rain. To test the role of aerosols and rain, the international team led by Feingold at NOAA's Earth System Research Laboratory in Boulder, Colo., used computer simulations and satellite images to explore how open-cell clouds develop and oscillate.

Shifting Showers

First, the team started with a computer model called the Weather Research and Forecasting model, which a team of scientists developed at the National Center for Atmospheric Research in Boulder, Colo. and NOAA. Wang and others improved upon it to study interactions of aerosols and low clouds.

For this study, they simulated fields of honeycomb clouds sitting below one kilometer (about 3/4 of a mile) over the ocean, where they are known as marine stratocumulus clouds. The team fed the clouds with just enough aerosols to produce rain and create the expected honeycomb shapes.

Though the open-cell clouds always looked like a honeycomb, the individual cells deformed and reformed over a couple hours. To determine why they changed in this way, the team took the open-cell clouds and examined air flow and rain along the cell walls.

Strong updrafts coincided with the presence of the thick vertical walls, the scientists found. Over time, however, these regions accumulated enough water to rain, which caused downdrafts. When adjacent downdrafts approached the ocean surface, they flowed outward and collided -- air converged and formed new updrafts. The air in the downdrafts cooled off initially by evaporation of raindrops, but warmed up again near the ocean, starting the updraft cycle again but shifted over in space.

This cycling of falling rain, downdrafts and updrafts caused cloud walls and their cells to disappear but reappear somewhere else in the field. The honeycomb-structure of the clouds remained, but cells shifted in space. The authors call these shifts oscillations in open cells.

The Real World

The team then looked at satellite images of real clouds. They used pictures of cloud fields at different times and corrected for them being blown about by wind flowing horizontally. Over time, they saw bright white spaces replaced by dark empty ones, and again replaced by bright whiteness. The team's computer model had replicated these oscillating light-dark cycles.

Wind and rain measurements also supported the simulation. Instruments on a ship on the ocean measured wind up to one kilometer high. The data showed outflows from rain in different parts of the sky collide at the ocean surface and flow back up. Instruments that measured precipitation showed periodic rainfall that coincided with the shifting cloud pattern.

Taken together, the set of experiments showed that rain causes open-cell clouds to form spontaneously, oscillate in the sky and resist change in the overall pattern. These are three characteristics of complex systems that self-organize and form a cell structure, such as flocks of birds or bubbles on a boiling surface.

This work was supported by NOAA, the Cooperative Institute for Research in Environmental Sciences and PNNL.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Pacific Northwest National Laboratory**.

Journal Reference:

1. Graham Feingold, Ilan Koren, Hailong Wang, Huiwen Xue, and Wm. Alan Brewer. **Precipitation-generated oscillations in open cellular cloud fields**. *Nature*, 2010; 466 (7308): 849 DOI: 10.1038/nature09314

http://www.sciencedaily.com/releases/2010/08/100811135035.htm

Menstrual Cramps May Alter Brain Structure

ScienceDaily (Aug. 11, 2010) — Primary dysmenorrhea (PDM), or menstrual cramps, is the most common gynecological disorder in women of childbearing age. Lower abdominal pain starts with the onset of menstrual flow and this ongoing pain stimulus can cause alterations throughout the nervous system.

In a study scheduled for publication in the September issue of the journal *Pain*, researchers report abnormal changes in the structure of the brain in PDM patients, whether or not they are in fact experiencing pain.

Lead investigator, Professor Jen-Chuen Hsieh, MD, PhD, Institute of Brain Science, National Yang-Ming University, Taipei, Taiwan, commented, "Our results demonstrated that abnormal GM [gray matter] changes were present in PDM patients even in absence of pain. This shows that not only sustained pain but also cyclic occurring menstrual pain can result in longer-lasting central changes. Although the functional consequences remain to be established, these results indicate that the adolescent brain is vulnerable to menstrual pain. Longitudinal studies are needed to probe hormonal interaction, fast-changing adaptation (intra-menstrual cycle) and whether such changes are reversible or not."

32 PDM patients and 32 age- and menstrual-cycle-matched controls participated in the study. MRI scans of each subject were obtained when the PDM patients were not experiencing pain, and maps of gray matter (GM) were created. Both the total GM volume and the GM volume of specific brain areas were determined for both PDM patients and controls.

In these anatomical maps, significant GM volume changes were observed in the PDM patients. Abnormal decreases were found in regions involved in pain transmission, higher level sensory processing, and affect regulation while increases were found in regions involved in pain modulation and in regulation of endocrine function.

Story Source:

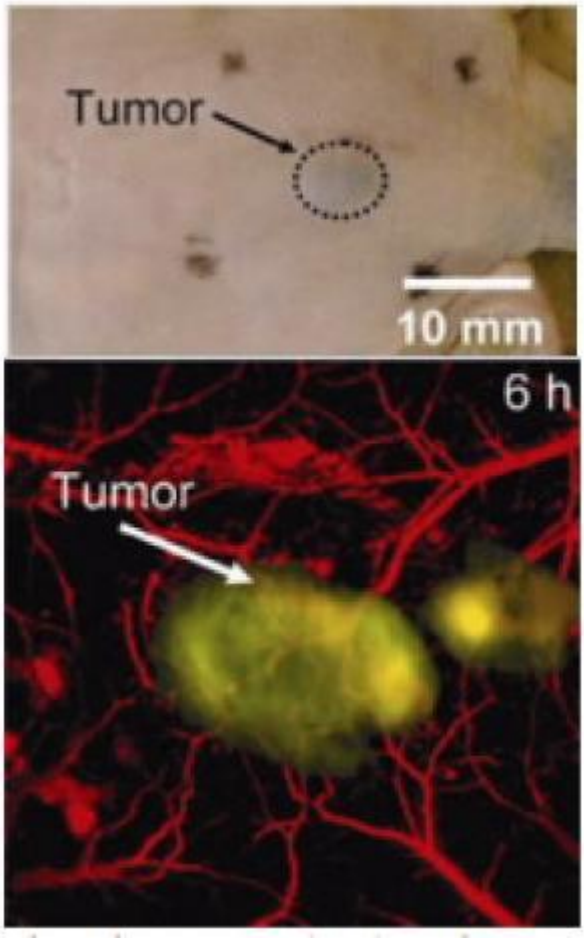
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Elsevier Health Sciences**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Cheng-Hao Tu, David M. Niddam, Hsiang-Tai Chao, Li-Fen Chen, Yong-Sheng Chen, Yu-Te Wu, Tzu-Chen Yeh, Jiing-Feng Lirng, and Jen-Chuen Hsieh. **Brain morphological changes associated with cyclic menstrual pain**. *Pain*, 2010; 150 (3): 462 DOI: 10.1016/j.pain.2010.05.026

http://www.sciencedaily.com/releases/2010/08/100811085408.htm

Advance Toward Earlier Detection of Melanoma



This skin tumor (top) is shown after treatment with a new contrast agent that can improve the visualization of skin cancer cells (bottom) using an advanced medical imaging device. (Credit: American Chemical Society)

ScienceDaily (Aug. 11, 2010) — Melanoma is one of the less common types of skin cancer but it accounts for the majority of the skin cancer deaths (about 75 percent).

The five-year survival rate for early stage melanoma is very high (98 percent), but the rate drops precipitously if the cancer is detected late or there is recurrence.

So a great deal rides on the accuracy of the initial surgery, where the goal is to remove as little tissue as possible while obtaining "clean margins" all around the tumor.

So far no imaging technique has been up to the task of defining the melanoma's boundaries accurately enough to guide surgery. Instead surgeons tend to cut well beyond the visible margins of the lesion in order to be certain they remove all the malignant tissue.

Two scientists at Washington University in St. Louis have developed technologies that together promise to solve this difficult problem.

Their solution, described in the July issue of *ACS Nano*, combines an imaging technique developed by Lihong Wang, PhD, the Gene K. Beare Distinguished Professor of Biomedical Engineering, and a contrast agent developed by Younan Xia, PhD, the James M. McKelvey Professor of Biomedical Engineering.

Together the imaging technique and contrast agent produce images of startling three-dimensional clarity.

Photoacoustic tomography

The imaging technique is based on the photoacoustic effect discovered by Alexander Graham Bell 100 years ago. Bell exploited the effect in what he considered his greatest invention ever, the photophone, which converted sound to light, transmitted the light and then converted it back to sound at the receiver.

(The public preferred the telephone to the photophone, by some facetious accounts because they just didn't believe wireless transmission was really possible.)

In Bell's effect, the absorption of light heats a material slightly, typically by a matter of millikelvins, and the temperature rise causes thermoelastic expansion.

"Much the same thing happens," says Wang "when you heat a balloon and it expands."

If the light is pulsed at the right frequency, the material will expand and contract, generating a sound wave.

"We detect the sound signal outside the tissue, and from there on, it's a mathematical problem," says Wang. "We use a computer to reconstruct an image."

"We're essentially listening to a structure instead of looking at it," says Wang.

"Using pure optical imaging, it is hard to look deep into tissues because light is absorbed and scattered," Wang explains. "The useful photons run out of juice within one millimeter."

Photoacoustic tomography (PAT) can detect deep structures that strongly absorb light because sound scatters much less than light in tissue.

"PAT improves tissue transparency by two to three orders of magnitude," says Wang.

Moreover, it's a lot safer than other means of deep imaging. It uses photons whose energy is only a couple of electron-volts, whereas X-rays have energies in the thousands of electron-volts. Positron emission tomography (PET) also requires high-energy photons, Wang says.

A smart contrast agent

Photoacoustic images of biological tissue can be made without the use of contrast agents, particularly if tissues are pigmented by molecules like hemoglobin or melanin.

Still, photoacoustic images of melanomas are fuzzy and vague around the edges. To improve the contrast between the malignant and normal tissue, Xia loads the malignant tissue with gold.

"Gold is much better at scattering and absorbing light than biological materials," Xia says. "One gold nanocage absorbs as much light as a million melanin molecules," says Xia.

Xia's contrast agent consists of hollow gold cages, so tiny they can only be seen through the color they collectively lend to the liquid in which they float.

By altering the size and geometry of the particles, they can be tuned to absorb or scatter light over a wide range of wavelengths.

In this way the nanoparticles behave quite differently than bulk gold.

For photoacoustic imaging, Xia's team tunes the nanocages to absorb strongly at 780 nanometers, a wavelength that falls within a narrow window of tissue transparency in the near-infrared.

Light in this sweet spot can penetrate as deep as several inches in the body.

Once injected, the gold particles naturally tend to accumulate in tumors because the cells that line a tumor's blood vessels are disorganized and leaky.

But Xia has dramatically increased the uptake rate by decorating the nanoparticles with a hormone that binds to hormone receptors on the melanoma's cells.

The molecule is alpha-melanocyte-stimulating hormone, slightly altered to make it more stable in the body. This hormone normally stimulates the production and release of the brown pigment melanin in the skin and hair.

As is true in many types of cancers, this hormone seems to stimulate the growth of cancerous cells, which produce more hormone receptors than normal cells.

In experiments with mice, melanomas took up four times as many "functionalized" nanocages than nanocages coated with an inert chemical. With the contrast agent, the photoacoustic signal from the melanoma was 36 percent stronger.

But seeing is believing. Subcutaneous mouse melanomas barely visible to the unaided eye show up clearly in the photoacoustic images, their subterranean peninsulas and islands of malignancy starkly revealed.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Washington University in St. Louis**. The original article was written by Diana Lutz and Gwen Ericsson.

Journal Reference:

1. Kim et al. **In Vivo Molecular Photoacoustic Tomography of Melanomas Targeted by Bioconjugated Gold Nanocages**. *ACS Nano*, 2010; 100722071528046 DOI: 10.1021/nn100736c

http://www.sciencedaily.com/releases/2010/08/100811125949.htm

Oldest Evidence of Stone Tool Use and Meat-Eating Among Human Ancestors Discovered: Lucy's Species Butchered Meat

These two bones from Dikika, which have been dated to roughly 3.4 million years ago, provide the oldest known evidence of stone tool use among human ancestors. Both of the cut-marked bones came from mammals -- one is a rib fragment from a cow-sized mammal, and the other is a femur shaft fragment from a goat-sized mammal. Both bones are marred by cut, scrape, and percussion marks. (Credit: Dikika Research Project, California Academy of Sciences)

ScienceDaily (Aug. 11, 2010) — The evolutionary stories of the Swiss Army Knife and the Big Mac just got a lot longer. An international team of scientists led by Dr. Zeresenay Alemseged from the California Academy of Sciences has discovered evidence that human ancestors were using stone tools and consuming meat from large mammals nearly a million years earlier than previously documented. While working in the Afar Region of Ethiopia, Alemseged's "Dikika Research Project" team found fossilized bones bearing unambiguous evidence of stone tool use -- cut marks inflicted while carving meat off the bone and percussion marks created while breaking the bones open to extract marrow.

The bones date to roughly 3.4 million years ago and provide the first evidence that Lucy's species, *Australopithecus afarensis*, used stone tools and consumed meat. The research is reported in the August 12 issue of the journal *Nature*.

"This discovery dramatically shifts the known timeframe of a game-changing behavior for our ancestors," says Alemseged, Curator of Anthropology at the California Academy of Sciences. "Tool use fundamentally altered the way our early ancestors interacted with nature, allowing them to eat new types of food and exploit new territories. It also led to tool making -- a critical step in our evolutionary path that eventually enabled such advanced technologies as airplanes, MRI machines, and iPhones."

Although the butchered bones may not look like particularly noteworthy fossils to the lay person, Alemseged can hardly contain his excitement when he describes them. "This find will definitely force us to revise our text books on human evolution, since it pushes the evidence for tool use and meat eating in our family back by nearly a million years," he explains. "These developments had a huge impact on the story of humanity."

Until now, the oldest known evidence of butchering with stone tools came from Bouri, Ethiopia, where several cut-marked bones were dated to about 2.5 million years ago. The oldest known stone tools, dated to around the same time, were found at nearby Gona, Ethiopia. Although no hominin fossils were found in direct association with the Gona tools or the Bouri bones, an upper jaw from an early Homo species dated to about 2.4 million years ago was found at nearby Hadar, and most paleoanthropologists believe the tools were made and used only by members of the genus Homo.

The new stone-tool-marked fossil animal bones from Dikika have been dated to approximately 3.4 million years ago and were found just 200 meters away from the site where Alemseged's team discovered "Selam" in 2000. Dubbed "Lucy's Daughter" by the international press, Selam was a young *Australopithecus afarensis* girl who lived about 3.3 million years ago and represents the most complete skeleton of a human ancestor discovered to date.

"After a decade of studying Selam's remains and searching for additional clues about her life, we can now add a significant new detail to her story," Alemseged notes. "In light of these new finds, it is very likely that Selam carried stone flakes and helped members of her family as they butchered animal remains."

The location and age of the butchered bones from Dikika clearly indicate that a member of the *A. afarensis* species inflicted the cut marks, since no other hominin lived in this part of Africa at this time. These fossils provide the first direct evidence that this species, which includes such famous individuals as Lucy and Selam, used stone tools.

"Now, when we imagine Lucy walking around the east African landscape looking for food, we can for the first time imagine her with a stone tool in hand and looking for meat," says Dr. Shannon McPherron, archeologist with the Dikika Research Project and research scientist at the Max Planck Institute for Evolutionary Anthropology in Leipzig. "With stone tools in hand to quickly pull off flesh and break open bones, animal carcasses would have become a more attractive source of food. This type of behavior sent us down a path that later would lead to two of the defining features of our species -- carnivory and tool manufacture and use."

To determine the age of the butchered bones, project geologist Dr. Jonathan Wynn relied on a very well documented and dated set of volcanic deposits in the Dikika area. These same deposits were previously used to determine Selam's age, and they are well known from nearby Hadar, where Lucy was found. The cut-marked bones at Dikika were sandwiched between volcanic deposits that have been securely dated to 3. 24 and 3.42 million years ago, and they were located much closer to the older sediment. "We can very securely say that the bones were marked by stone tools between 3.42 and 3.24 million years ago, and that within this range, the date is most likely 3.4 million years ago," says Wynn, a geologist at the University of South Florida.

Both of the cut-marked bones discovered at Dikika came from mammals -- one is a rib fragment from a cow-sized mammal, and the other is a femur shaft fragment from a goat-sized mammal. Both bones are marred by cut, scrape, and percussion marks. Microscope and elemental analysis using secondary electron imaging and energy dispersive x-ray spectrometry demonstrated that these marks were created before the bones fossilized, meaning that recent damage can be eliminated as the cause of the marks. Additionally, the marks were consistent with the morphology of stone-inflicted cuts rather than tooth-inflicted marks. Dr. Hamdallah Bearat from the Ira A. Fulton Schools of Engineering at Arizona State University determined that one cut-mark even contained a tiny, embedded piece of rock that was likely left behind during the butchering process.

"Most of the marks have features that indicate without doubt that they were inflicted by stone tools," explains Dr. Curtis Marean from the Institute of Human Origins at Arizona State University, who helped with the mark identifications. "The range of actions that created the marks includes cutting and scraping for the removal of flesh, and percussion on the femur for breaking it to access marrow."

While it is clear that the Australopithecines at Dikika were using sharp-edged stones to carve meat from bones, it is impossible to tell from the marks alone whether they were making their tools or simply finding and using naturally sharp rocks. So far, the research team has not found any flaked stone tools at Dikika from this early time period. This could indicate that the Dikika residents were simply opportunistic about finding and using sharp-edged stones. However, the sedimentary environment at the site suggests another potential explanation.

"For the most part, the only stones we see coming from these ancient sediments at Dikika are pebbles too small for making tools," says McPherron. "The hominins at this site probably carried their stone tools with them from better raw material sources elsewhere. One of our goals is to go back and see if we can find these locations, and look for evidence that at this early date they were actually making, not just using, stone tools."

Regardless of whether or not Selam and her relatives were making their own tools, the fact that they were using them to access nutritious meat and marrow from large mammals would have had wide-ranging implications for *A. afarensis* both physically and behaviorally."We now have a greater understanding of the selective forces that were responsible for shaping the early phases of human history," says Alemseged. "Once our ancestors started using stone tools to help them scavenge from large carcasses, they opened themselves up to risky competition with other carnivores, which would likely have required them to engage in an unprecedented level of teamwork."

While many questions remain about the history of tool use, tool making, and related dietary changes among human ancestors, this discovery adds a rich new chapter to the story -- a story that is deeply relevant to what makes us unique as a species.This research was conducted under the auspices of the Ethiopian Authority for Research and Conservation of Cultural Heritage / Ministry of Culture and Tourism. Financial support for the 2009 field and laboratory work was provided by the California Academy of Sciences. Travel expenses for D.G., S.P.M., D.N.R. and J.G.W. were covered by their respective institutions.

Story Source:

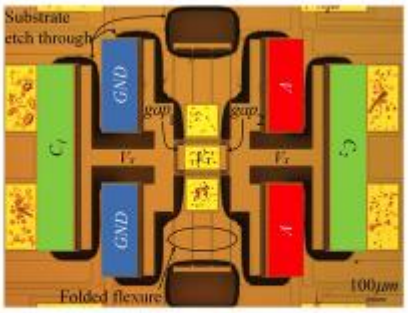
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **California Academy of Sciences**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Shannon P. McPherron, Zeresenay Alemseged, Curtis W. Marean, Jonathan G. Wynn, Denné Reed, Denis Geraads, René Bobe, Hamdallah A. Béarat. **Evidence for stone-tool-assisted consumption of animal tissues before 3.39 million years ago at Dikika, Ethiopia**. *Nature*, 2010; 466 (7308): 857 DOI: 10.1038/nature09248

http://www.sciencedaily.com/releases/2010/08/100811135039.htm

Innovation Could Bring Super-Accurate Sensors, Crime Forensics



A first generation, self-calibratable MEMS. It has been used to measure the Casimir forces between gap1 and gap2.

This image depicts a device that enables tiny micro electromechanical systems to "self-calibrate," an advance that could make possible super-accurate sensors, a "nose-on-a-chip" for law enforcement and a new class of laboratory tools for specialists working in nanotechnology and biotechnology. (Jason Vaughn Clark, Purdue University Birck Nanotechnology Center) (Credit: Image courtesy of Purdue University)

ScienceDaily (Aug. 11, 2010) — A new technology enabling tiny machines called micro electromechanical systems to "self-calibrate" could make possible super-accurate and precise sensors for crime-scene forensics, environmental testing and medical diagnostics.

The innovation might enable researchers to create a "nose-on-a-chip" for tracking criminal suspects, sensors for identifying hazardous solid or gaseous substances, as well as a new class of laboratory tools for specialists working in nanotechnology and biotechnology.

"In the everyday macroscopic world, we can accurately measure distance and mass because we have well-known standards such as rulers or weights that we use to calibrate devices that measure distances or forces," said Jason Vaughn Clark, an assistant professor of electrical and computer engineering and mechanical engineering. "But for the micro- or nanoscopic worlds, there have been no standards and no practical ways for measuring very small distances or forces."

The micro electromechanical systems, or MEMS, are promising for an array of high-tech applications.

Researchers previously have used various techniques to gauge the force and movement of tiny objects containing components so small they have to be measured on the scale of micrometers or nanometers, millionths or billionths of a meter, respectively. However, the accuracy of conventional techniques is typically off by 10 percent or more because of their inherent uncertainties, Clark said.

"And due to process variations within fabrication, no two microstructures have the same geometric and material properties," he said.

These small variations in microstructure geometry, stiffness and mass can significantly affect performance.

"A 10 percent change in width can cause a 100 percent change in a microstructure's stiffness," Clark said. "Process variations have made it difficult for researchers to accurately predict the performance of MEMS."

The new technology created by Clark, called electro micro metrology -- or EMM -- is enabling engineers to account for process variations by determining the precise movement and force that's being applied to, or sensed by, a MEMS device.

"For the first time, MEMS can now truly self-calibrate without any external references," Clark said. "That is, our MEMS are able to determine their unique mechanical performance properties. And in doing so, they become very accurate sensors or actuators."

Research findings were detailed in two papers presented in June during a meeting of the Society of Experimental Mechanics in Indianapolis and at the Nanotech 2010 Conference and Expo in Anaheim, Calif. The work is based at the Birck Nanotechnology Center in Purdue's Discovery Park.

MEMS accelerometers and gyroscopes currently are being used in commercial products, including the Nintendo Wii video game, the iPhone, walking robots and automotive airbags.

"Those MEMS work well because they don't need ultra-high precision or accuracy," Clark said. "It is difficult for conventional technology to accurately measure very small forces, such as van der Waals forces between molecules or a phenomenon called the Casimir effect that is due to particles popping in and out of existence everywhere in the universe."

These forces are measured in "piconewtons," a trillionth of the weight of a medium-size apple.

"If we are trying to investigate or exploit picoscale phenomena like Casimir forces, van der Waals forces, the hydrogen bond forces in DNA, high-density data storage or even nanoassembly, we need much higher precision and accuracy than conventional methods provide," Clark said. "With conventional tools, we know we are sensing something, but without accurate measurements it is difficult to fully understand the phenomena, repeat the experiments and create predictive models."

Self-calibration also is needed because microdevices might be exposed to harsh environments or remain dormant for long periods.

"Say you have a MEMS sensor in the environment or on a space probe," Clark said. "You want it to be able to wake up and recalibrate itself to account for changes resulting from temperature differences, changes in the gas or liquid ambient, or other conditions that might affect its properties. That's when self-calibration technology is needed."

EMM defines mechanical properties solely in terms of electrical measurements, which is different than conventional methods, he said.

For example, by measuring changes in an electronic property called capacitance, or the storage of electrical charge, Clark is able to obtain the microstructure's shape, stiffness, force or displacement with high accuracy and precision, he said.

"We can measure capacitance more precisely than we can measure any other quantity to date," he said. "That means we could potentially measure certain mechanical phenomena more precisely by using MEMS than we could by using conventional macroscale measurement tools."

The researcher will use the new approach to improve the accuracy of instruments called atomic force microscopes, which are used by nanotechnologists.

"The atomic force microscope, which jumpstarted the nanotechnology revolution, is often used to investigate small displacements and forces," Clark said. "But the operator of the tool cannot precisely say what distance or force is being sensed beyond one or two significant digits. And the typical operator knows even less about the true accuracy of their measurements."

Purdue operates about 30 atomic force microscopes, and Clark's research group is planning to teach users how to calibrate their instruments using the self-calibrating MEMS.

He also plans to use his new approach to create a miniature self-calibrating "AFM-on-a-chip," dramatically shrinking the size and cost of the laboratory instrument.

"Such an advent should open the door to the nanoworld to a much larger number of groups or individuals," he said.

Clark's research group has fabricated and tested the first generation of self-calibrating MEMS, and repeatable results have shown the presence of the Casimir and van der Waals forces.

The research is funded by the National Science Foundation.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Purdue University**. The original article was written by Emil Venere.

http://www.sciencedaily.com/releases/2010/08/100810122158.htm

Dogs' Physical Traits Controlled by Small Number of Genetic Regions, Researcher Finds

Physical attributes can vary wildly among different breeds of dog. Now, a team of researchers has found that these attributes are determined by only a few genetic regions. (Credit: iStockphoto)

ScienceDaily (Aug. 11, 2010) — Sure, dogs are special. You might not be aware, however, that studying their genomes can lead to advances in human health. So next time you gaze soulfully into a dog's eyes or scratch behind its ears, take note of the length of his nose or the size of his body. Although such attributes can vary wildly among different breeds, a team of investigators co-led by researchers at Stanford University School of Medicine, Cornell University and the National Human Genome Research Institute has found that they are determined by only a few genetic regions.

The discovery shows how studying genetic differences among dog breeds may ultimately help us understand human biomedical traits, such as height, hair color and body weight, that are usually influenced by the net impact of hundreds of different genes in our species. The key idea is that identifying the dozen regions where dogs harbor genetic switches among breeds will provide critical clues as to where researchers could find mutations important to human health and disease.

The study describes the most comprehensive genetic analysis of dogs to date, in which the researchers genotyped more than 900 individual dogs and assessed nearly 60 specific physical traits, and found that only a few genetic regions determine much of a dog's appearance.

"We've found that only six or seven locations in the dog genome are necessary to explain about 80 percent of the differences in height and weight among dog breeds," said Carlos Bustamante, PhD, professor of genetics at Stanford. "In humans these are controlled by hundreds if not thousands of variants."

The research will be published on Aug. 10 in *PLoS Biology*, published by the Public Library of Science. Bustamante is a co-senior author of the study; Stanford research associate Adam Boyko, PhD, is one of three co-first authors. Elaine Ostrander, PhD, chief of the Cancer Genetics Branch of the National Human Genome

Research Institute is the other senior author. Bustamante and Boyko began the work while they were at Cornell.

The work is a product of an intensive collaboration called the CanMap project, which involves several groups around the country including NHGRI, Cornell, the University of California-Los Angeles and now Stanford. The CanMap groups are using the dog as a model system to identify genomic regions responsible for many key physical characteristics. Although a few individual relationships, including an association between small body size and a gene called IGF-1, have been previously reported by the groups, many others were identified for the first time in this new analysis.

Dogs have been our companions and protectors for thousands of years. During this time, dogs adapted to living near human settlements largely through natural selection for being able to survive among people. But recently we humans decided to take things into our own hands. Driven sometimes by a love of novelty and other times by usefulness, our relentless breeding campaigns have left us with the Great Dane and the Chihuahua, the collie and the bulldog, and many more. As a result of our meddling, the dog is now the physically most diverse land animal.

"This dizzying array of morphological variants has happened extraordinarily quickly in terms of evolutionary timescales, due to extraordinarily strong selection by humans," said Bustamante. "Most dog breeds are only a couple of hundred years old."

All told, there are about 57 phenotypic traits that were used to visually differentiate one breed from another, including body size, snout length and ear type. The CanMap project set out to identify what regions of the dog genome contributed to each of these different traits. They didn't know whether the differences in appearance from breed to breed resulted from many genetic mutations, each of which makes a small contribution to a dog's appearance, or if they were due to only a few, powerful changes.

To answer the question, the NHGRI team genotyped more than 60,000 single genetic changes called SNPs (for single nucleotide polymorphisms) in 915 dogs. The dogs included representatives of 80 domestic breeds, 83 wild canids such as wolves, foxes and coyotes, and 10 Egyptian village dogs -- domesticated but of no particular breed.

The CanMap researchers used the SNPs to identify chunks of DNA shared among individual dogs of the same breed. They found that while purebred dogs tended to share large stretches of DNA with other members of their breed, the wild dogs and village mongrels were more variable. They then looked to see which regions varied with specific physical traits from breed to breed.

The researchers found that -- in contrast to humans -- many physical traits in dogs are determined by very few genetic regions. For example, a dog with version A of the "snout length" region may have a long, slender muzzle, while version B confers a more standard nose and C an abnormally short schnoz. And let's say X, Y and Z in the "leg length" region bestow a range of heights from short to tall. That would mean that in this example an A/X dog would have a slender muzzle and short legs like a dachshund. C/Y might be a bulldog, while B/Z would be more like a Labrador. This mixing and matching of chunks of DNA is how breeders were able to come up with so many different breeds in a relatively short amount of time.

Determining the differences between dog breeds may seem inconsequential, but it has important implications for human health.

"Understanding the genetic bases of complex traits in humans is difficult because many different genes can influence a particular trait," explained Bustamante. "Having model systems, such as mice and dogs, is critical for making sense of the biology. For example, one of the strongest associations in human genetics is between a common variant in a gene called HMGA2 and height. In our study, we also see a strong association with body size and HMGA2 (just as we see at IGF-1 in humans, mice and dogs and body-size variation within each species). This suggests that studying what underlies the HMGA2 association in dogs could help us understand the relationship in humans. In this way, dogs are a fantastic model system since they complement mouse and human genetics."

In the future, the researchers plan to investigate whether dog behavioral traits can be linked to specific genomic regions, and how these regions may be important in mammalian behavior.

In addition to Bustamante and Boyko, Stanford postdoctoral fellow Keyan Zhao, PhD, participated in the study. The two other co-first authors are Pascale Quignon, PhD, a former postdoc of Ostrander's at NHGRI, and Lin Li, PhD, a former graduate student of Bustamante's at Cornell. Other collaborators include researchers from Cornell, NHGRI, UCLA, Affymetrix Corp. and the University of Missouri.

The research was funded by the National Institutes of Health, the National Science Foundation, the Cornell Center for Vertebrate Genomics and NHGRI.

Story Source:

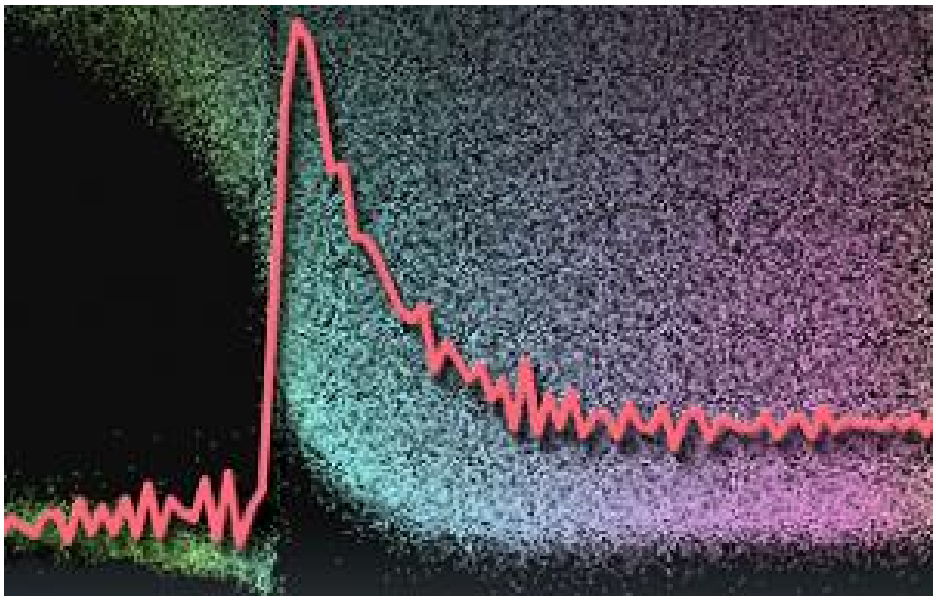
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Stanford University Medical Center**. The original article was written by Krista Conger.

Journal Reference:

1. Adam R Boyko, Pascale Quignon, Lin Li, Jeffrey J Schoenebeck, Jeremiah D Degenhardt, Kirk E Lohmueller, Keyan Zhao, Abra Brisbin, Heidi G Parker, Bridgett M vonHoldt, Michele Cargill, Adam Auton, Andy Reynolds, Abdel G Elkahloun, Marta Castelhano, Dana S Mosher, Nathan B Sutter, Gary S Johnson, John Novembre, Melissa J Hubisz, Adam Siepel, Robert K Wayne, Carlos D Bustamante, Elaine A Ostrander. **A Simple Genetic Architecture Underlies Morphological Variation in Dogs**. *PLoS Biology*, 2010; 8 (8): e1000451 DOI: 10.1371/journal.pbio.1000451

http://www.sciencedaily.com/releases/2010/08/100810203503.htm

Scientists Show There's Nothing Boring About Watching Paint Dry



Microscopic fluorescent tracking particles reveal a side view of the coating as it peels, with a plot of the stress exerted on the surface. (Credit: Graphic design by Wendolyn Hill with data from Ye Xu and Eric Dufresne)

ScienceDaily (Aug. 11, 2010) — It turns out that watching paint dry might not be as boring as the old adage claims. A team led by Yale University researchers has come up with a new technique to study the mechanics of coatings as they dry and peel, and has discovered that the process is far from mundane.

In the August 9-13 edition of the *Proceedings of the National Academy of Sciences*, the team presents a new way to image and analyze the mechanical stress that causes colloidal coatings -- those in which microscopic particles of one substance are dispersed throughout another -- to peel off of surfaces.

Understanding how and why coatings fail has broad applications in the physical and biological sciences, said Eric Dufresne, the John J. Lee Associate Professor of Mechanical Engineering at Yale and lead author of the study.

"Coatings protect almost every surface you encounter, from paint on a wall to Teflon on a frying pan to the skin on our own bodies. When coatings peel and crack they put the underlying material at risk," Dufresne said. "Our research is aimed at pinpointing the failure of coatings. We've developed this new technique to zoom in on coatings and watch them fail at the microscopic level."

To visualize the microscopic motion of paint in 3D, the team mixed in tiny fluorescent particles that glow when illuminated by a laser. By tracing the motion of these particles over time with a microscope, they captured the motion of the paint as it peeled and dried in detail.

In addition, the team was able to track the 3-D forces generated by the paint as it dried, producing a "stress map" of the mechanical deformation of the coating as it failed. "The trick was to apply the paint to a soft

surface, made of silicone rubber, that is ever so slightly deformed by the gentle forces exerted by the drying paint," Dufresne said.

Although the current study focuses on colloidal coatings, the technique could be applied to all kinds of coatings, Dufresne said. Next, the team hopes to improve on current methods for mitigating peeling in a wide range of coatings.

"This is a completely new way of looking at a very old problem."

Other authors of the study include Ye Xu, Wilfried Engl, Elizabeth Jerison and Callen Hyland (Yale University); Kevin Wallenstein (Princeton University); and Larry Wilen (Unilever).

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Yale University**.

Journal Reference:

1. Y. Xu, W. C. Engl, E. R. Jerison, K. J. Wallenstein, C. Hyland, L. A. Wilen, E. R. Dufresne. **Imaging in-plane and normal stresses near an interface crack using traction force microscopy**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1005537107

http://www.sciencedaily.com/releases/2010/08/100810122212.htm

Indonesian Ice Field May Be Gone in a Few Years, Core May Contain Secrets of Pacific El Nino Events

Above, one of the drill camps perched precariously between cravasses in the ice field. (Credit: Photo courtesy of Lonnie Thompson, Ohio State University.)

ScienceDaily (Aug. 11, 2010) — Glaciologists who drilled through an ice cap perched precariously on the edge of a 16,000-foot-high Indonesian mountain ridge say that the ice field could vanish within in the next few years, another victim of global climate change.

The Ohio State University researchers, supported by a National Science Foundation grant and the Freeport-McMoRan mining company and collaborating with Meteorological, Climatological and Geophysical Agency (BMKG) Indonesia and Columbia University, drilled three ice cores, two to bedrock, from the peak's rapidly shrinking ice caps.

They hope these new cores will provide a long-term record of the El Nino-Southern Oscillation (ENSO) phenomenon that dominates climate variability in the tropics.

"We were able to bring back three cores from these glaciers, one 30 meters (98.4 feet) long, one 32 meters (105 feet) long and the third 26 meters (85 feet) long," explained Lonnie Thompson, Distinguished University Professor in the School of Earth Sciences and a senior researcher with Ohio State's Byrd Polar Research Center.

While the cores are relatively short compared to those retrieved during some of Thompson's previous 57 expeditions, "We won't know what history they contain until we do the analyses." A short 50-meter core previously drilled in 2000 through ice fields atop Mount Kilimanjaro in Africa yielded an 11,700-year history of climate.

This project is largely focused on capturing a record of ENSO. Last year, Thompson's team drilled through an ice cap atop Hualcán, a mountain in the Peruvian Andes on the eastern side of the Pacific Ocean.

From there, they brought back a 189-meter (620-foot) and a 195-meter (640-foot) core (to bedrock) from which they are reconstructing a high-resolution climate record going back over 500 years. The Hualcán record

should complement the more recent part of their 19,000-year record recovered from nearby Huascarán in 1993.

This year's effort focused on several small and rare ice fields almost due west of the Andes on the other side of the Pacific -- near a mountain called Puncak Jaya. Along with the ice core, the team collected rainwater samples from locations ranging in elevation from sea level up to the site of the glacier.

Coupled with weather data garnered from 11 weather stations operated by Freeport-McMoRan, the isotopic composition of the rainwater samples will help the team interpret the climate history locked in the ice cores.

The relative abundances of the stable isotopes of oxygen and hydrogen provide a proxy for temperature, while concentrations of different chemical species preserved in the ice reveal changes in the atmosphere such as those occurring during major volcanic eruptions.

Elevated dust content in the ice may signal increased drought while the presence of specific organic compounds may reflect increased fire activity (forest burning).

Radioactivity from atomic bomb tests in the 1950s and 1960s provide time markers that help date the cores. However, cores recently collected from Himalayan ice fields lacked these radioactive layers indicating the glaciers are now losing mass from the surface down, destroying the time markers.

The drill site itself was hazardous. "The area was riddled with crevasses and lacked any substantial snowfall," Thompson said. This meant that the team had to wear crampons -- pointed metal cleats on their boots -- to maneuver on the ice. Daily rainstorms in the area, complete with lightning, increased the risks at the drill site.

The expedition was stalled almost before it began when a pallet containing the ice core drills was missing from the equipment delivered to the drill site. Inquiries with the shipping company failed to uncover the missing pieces SO Freeport-McMoRan offered their own machine shop to fabricate a new drill. While that effort got underway, Thompson, Freeport liaison Scott Hanna and researcher Dwi Susanto of Columbia University flew back to Jakarta and eventually found the lost equipment inside the shipper's warehouse.

Near the end, the project came close to catastrophe again at the end when members of a local native tribe, after failing in their attempt to reach the ice core drilling site, broke into the freezer facility where the cores were stored, intent on destroying them. Company officials, fearing the worst, had secretly transported the ice to another facility for safekeeping a few hours earlier.

Four local tribes claim the ice fields as their own, Thompson said. "They believe that the ice is their god's skull, that the mountains are its arms and legs and that we were drilling into the skull to steal their memories," he said. "In their religion they are a part of nature, and by extension they are a part of the ice, so if it disappears, a part of their souls will also be lost."

Several days later, at a public forum arranged by Freeport-McMoRan, Thompson addressed over 100 tribal members and Freeport employees to explain the importance of the project to understanding local to global climate changes. After 4.5 hours of discussion, the local people agreed to allow the ice cores to be returned to Ohio State for analysis.

Thompson said that the project could never have been done without the aid of Freeport-McMoRan which provided aircraft and helicopter support, provided cooks and food for the drill camp, and long-term storage of the ice cores and safe transport of the ice from Papua back to Jakarta.

"They provided hundreds of thousands of dollars worth of support to the project. And the result is that these cores are in the best possible condition of any core we've ever brought out of the field," Thompson said.

The ice fields near Punkak Jaya are tiny. Together they total barely 1.7 square kilometers (0.6 square miles), an area very similar to the current 1.8 square kilometers (0.7 square miles) on the summit of Mount Kilimanjaro in Africa. An analysis of the first of the cores is expected by December, the researchers said.

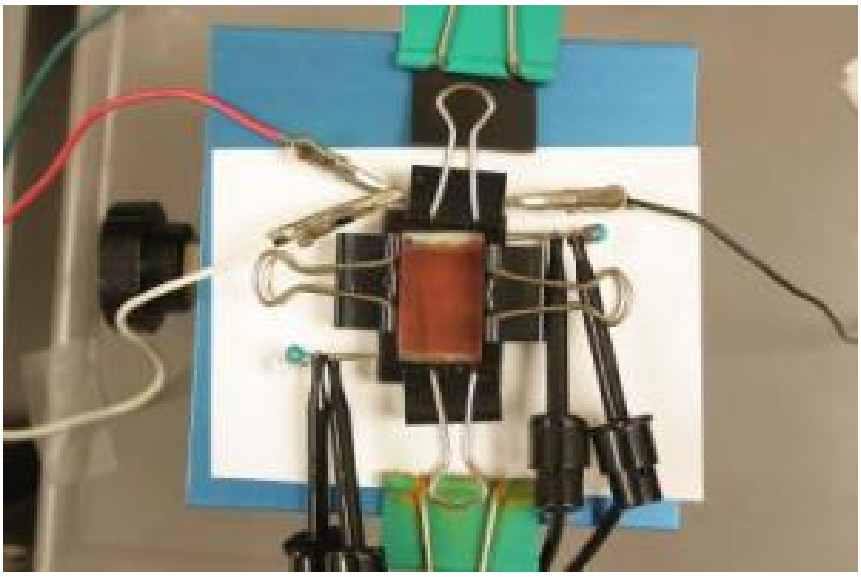
Along with Thompson, the team included postdoctoral fellow Broxton Bird; research scientist Paolo Gabrielli; graduate student Donaldi Permana; glaciologist and engineer Victor Zagorodnov, -- all from Ohio State -- Keith Mountain, a professor of geography and geosciences at the University of Louisville; and glaciologist and engineer Vladimir Mikhalenko from the Institute of Geography in the Russian Academy of Sciences.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Ohio State University**. The original article was written by Earle Holland.

http://www.sciencedaily.com/releases/2010/08/100810101728.htm

Better Displays Ahead



This is a prototype of the vertical stack multi-color electrowetting display device is shown in the photograph. Arrays of ~1,000-2,000 pixels were constructed with pixel sizes of 200 × 600 and 300 × 900 µm. (Credit: American Institute of Physics)

ScienceDaily (Aug. 11, 2010) — Sleek design and ease of use are just two of the main reasons consumers are increasingly attracted to tablets and e-readers. And these devices are only going to get better -- display technology improvements are on the way.

Several e-reader products on the market today use electrophoretic displays, in which each pixel consists of microscopic capsules that contain black and white particles moving in opposite directions under the influence of an electric field. A serious drawback to this technology is that the screen image is closer to black-on-gray than black-on-white. Also, the slow switching speed (~1 second) due to the limited velocity of the particles prevents integration of other highly desirable features such as touch commands, animation, and video.

Researchers at the University of Cincinnati Nanoelectronics Laboratory are actively pursuing an alternative approach for low-power displays. Their assessment of the future of display technologies appears in the American Institute of Physics' *Applied Physics Letters*.

"Our approach is based on the concept of vertically stacking electrowetting devices," explains professor Andrew J. Steckl, director of the NanoLab at UC's Department of Electrical and Computer Engineering. "The electric field controls the 'wetting' properties on a fluoropolymer surface, which results in rapid manipulation of liquid on a micrometer scale. Electrowetting displays can operate in both reflective and transmissive modes, broadening their range of display applications. And now, improvements of the hydrophobic insulator material and the working liquids enable EW operation at fairly low driving voltages (~15V)."

Steckl and Dr. Han You, a research associate in the NanoLab, have demonstrated that the vertical stack electrowetting structure can produce multi-color e-paper devices, with the potential for higher resolution than

the conventional side-by-side pixel approach. Furthermore, their device has switching speeds that enable video content displays.

What does all of this mean for the consumer? Essentially, tablets and e-readers are about to become capable of even more and look even better doing it. Compared to other technologies, electrowetting reflective display screens boast many advantages. The electrowetting displays are very thin, have a switching speed capable of video display, a wide viewing angle and, just as important, Steckl says, they aren't power hogs.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Institute of Physics**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. H. You, A. J. Steckl. **Three-color electrowetting display device for electronic paper**. *Applied Physics Letters*, 2010; 97 (2): 023514 DOI: 10.1063/1.3464963

http://www.sciencedaily.com/releases/2010/08/100810122033.htm

Walking to School Could Reduce Stress Reactivity in Children, May Curb Risk of Heart Disease

ScienceDaily (Aug. 11, 2010) — A simple morning walk to school could reduce stress reactivity in children during the school day, curbing increases in heart rate and blood pressure that can lead to cardiovascular disease later in life, according to a new University at Buffalo study.UB researchers report in the August 2010 issue of *Medicine & Science in Sports & Exercise* that children who took a simulated walk to school later experienced smaller elevations in systolic blood pressure, heart rate and perceived stress while taking a short exam than children who had gotten a simulated ride to school.

Cardiovascular reactivity -- including changes in heart rate and blood pressure due to stress -- is associated with the beginnings of cardiovascular disease in children, and atherosclerosis -- the dangerous build-up of cholesterol, calcium, fat and other substances in artery walls -- in adults."The cardiovascular disease process begins in childhood, so if we can find some way of stopping or slowing that process, that would provide an important health benefit," says James Roemmich, UB associate professor of pediatrics and exercise and nutrition science and senior investigator on the study, which he completed with graduate students Maya Lambiase and Heather Barry. "We know that physical activity has a protective effect on the development of cardiovascular disease, and one way it may be doing so is by reducing stress reactivity."

Roemmich says because it's not known how long the protective effect of a bout of exercise lasts, parents and educators should promote active play time throughout the day."If it only lasts a couple of hours, then it would be most beneficial if a child walked or biked to school, then had recess during school, as well as a break at lunch, so they had opportunities for physical activity throughout the day," Roemmich says. "This would put them in a constantly protective state against stressors that they're incurring during the school day, whether that be taking an exam, trying to fit in with peers or speaking in front of classmates."Roemmich says his study is the first to show that moderate-intensity exercise can reduce children's cardiovascular reactivity during later, stressful activities. The research builds on his earlier work, which demonstrated that higher-intensity interval exercise could afford similar protection in children.In the more recent investigation, Roemmich and his team examined a group of 20 boys and 20 girls, all Caucasian and ages 10-14. All visited the Behavioral Medicine Research Laboratory in the morning. To simulate a ride to school, half sat in a comfortable chair and watched a 10-minute slide show of images of a suburban neighborhood, ending with an image of a suburban school. The other half performed a one-mile walk on a treadmill at a self-selected pace, wearing a book bag containing 10 percent of their body weight. As they walked, the images of the suburban neighborhood were projected onto a screen.Following a 20-minute rest period after completing the passive and active commutes, all children took a Stroop test, which asks subjects to correctly identify the color of color names printed in the wrong color (the word "green" printed in blue ink, for instance). On average, during this activity, heart rate increased by about three beats per minute in children who walked, compared with about 11 beats per minute in children who "rode" to school. Similarly, the rise in systolic blood pressure was more than three times higher, and the change in perceived stress about twice as high, for the passive commuters.

"The perception of a stressor as a threat is the beginning of the stress reactivity process, so if you can dampen that initial perception, then you reduce the magnitude of the fight-or-flight response," Roemmich says. "This results in lower heart rate and blood pressure responses to the stressor. Exercise helped dampen even the initial response."

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University at Buffalo**.

http://www.sciencedaily.com/releases/2010/08/100810131628.htm

Dinosaur man: playing creationists at their own game

- 12 August 2010 by **Jeff Hecht**

Magazine issue 2772.

Questions of science and belief (Image: Phil Senter)

*Palaeontologist **Phil Senter** has a persuasive strategy for convincing doubters that all life on Earth has a common origin*

As an evolutionary biologist and atheist you've used the research techniques of creation science? What are they exactly?

Creation scientists take data from nature and try to reconcile it with a literal interpretation of the Bible, such as the creation of the world in six days. Nowadays many have real scientific training, with PhDs in geology, biology or chemistry, and their procedures often involve testing of hypotheses through observation and experimentation - the essence of science - although mainstream scientists interpret their results very differently.

Why are you using these techniques?

It's important to demonstrate evolution in a way that cannot be countered by creation science. One way of doing this is to use creation science itself to demonstrate evolutionary principles.

How is it possible to use creation science to evaluate evolution?

Like evolutionists, creationists assess relationships between animals by comparing their morphology [physical characteristics] and their molecules. They continue to doubt the geologic timescale and that all life shares a common origin, but most creation scientists accept other evolutionary concepts such as natural selection and beneficial mutations. Creationists believe different "kinds" of organisms - "baramins" - were created separately about 6000 years ago. They accept that diversification has taken place within each baramin and

have methods for determining whether different species belong to different baramins, by finding morphological gaps between species, or large differences in genes or molecules.

You used creation science to prove that birds evolved from dinosaurs. How does that work?

I used a statistical technique called classic multidimensional scaling, which creation scientists use to quantify morphological gaps between species. I wanted to determine whether morphological gaps separated *Archaeopteryx* - the earliest known bird - from the various non-avian coelurosaurs, the group of predatory dinosaurs ranging from tiny *Microraptor* to giant *T. rex*. I showed that within this group there is too much similarity to indicate separate baramins. Contrary to the previous creationist view that these animals were separately created, their own pet technique shows that these animals shared a common ancestor (*Journal of Evolutionary Biology*, vol 23, p 1732)

How have creation scientists reacted to your findings?

So far the reaction has been positive. The creationist camp's militant reputation comes mainly from vocal but ignorant internet posters. Creation scientists themselves tend to be well educated and polite. My own attitude - building bridges plus engaging in friendly mischief such as my paper - may contribute to the positive reaction from "the other side". My goal is not to make enemies with cold-hearted debunking, but rather to set the record straight about certain things that both sides need to be educated about.

Profile

Phil Senter is a biologist at Fayetteville State University in North Carolina who studies dinosaur palaeontology. The son of southern Baptist missionaries, he was a creationist until he learned about evolution at high school

http://www.newscientist.com/article/mg20727725.800-dinosaur-man-playing-creationists-at-their-own-game.html

P ≠ NP? It's bad news for the power of computing

- 14:35 10 August 2010 by **Richard Elwes**

Has the biggest question in computer science been solved? On 6 August, Vinay Deolalikar, a mathematician at Hewlett-Packard Labs in Palo Alto, California, sent out draft copies of a paper titled simply "P ≠ NP".

This terse assertion could have profound implications for the ability of computers to solve many kinds of problem. It also answers one of the Clay Mathematics Institute's seven Millennium Prize problems, so if it turns out to be correct Deolalikar will have earned himself a prize of $1 million.

The P versus NP question concerns the speed at which a computer can accomplish a task such as factorising a number. Some tasks can be completed reasonably quickly – in technical terms, the running time is proportional to a polynomial function of the input size – and these tasks are in class P.

If the answer to a task can be checked quickly then it is in class NP.

So if P = NP, every problem that can be checked quickly can also be completed quickly. That outcome would have huge repercussions for internet security, where the difficulty of factorising very large numbers is the primary means by which our data is kept safe from hackers.

Ingenious argument

But Deolalikar says that's not the way it is. His argument revolves around a particular task, the Boolean satisfiability problem, which asks whether a collection of logical statements can all be simultaneously true or whether they contradict each other. This is known to be an NP problem.

Deolalikar claims to have shown that there is no program which can complete it quickly from scratch, and that it is therefore not a P problem. His argument involves the ingenious use of statistical physics, as he uses a mathematical structure that follows many of the same rules as a random physical system.

If the result stands, it would prove that the two classes P and NP are not identical, and impose severe limits on what computers can accomplish – implying that many tasks may be fundamentally, irreducibly complex.

For some problems – including factorisation – the result does not clearly say whether they can be solved quickly. But a huge sub-class of problems called "NP-complete" would be doomed. A famous example is the travelling salesman problem – finding the shortest route between a set of cities. Such problems can be checked quickly, but if P ≠ NP then there is no computer program that can complete them quickly from scratch.

Complexity theorists have given a favourable reception to Deolalikar's draft paper, but when the final version is released in a week's time the process of checking it will intensify.

http://www.newscientist.com/article/dn19287-p--np-its-bad-news-for-the-power-of-computing.html

Rise in childhood obesity is slowing worldwide

- 06 August 2010 by **Andy Coghlan**

Magazine issue 2772.

It's a start (Image: Wang Zhide/Getty Images)

IN A dramatic twist in the tale of the world's obesity epidemic, it appears that childhood obesity levels have stopped rising in many rich nations around the world. Some claim it is proof that healthy-eating campaigns are working, while others are concerned that the data hides discrepancies between rich and poor compatriots.

Together with a research review that shows the stabilisation of childhood obesity rates, or even their decrease, in 15 countries worldwide over the past decade (see map), new data also showing obesity levelling off was presented at the International Congress on Obesity in Stockholm, Sweden, last month.

However, the claimed plateau is no excuse to relax the battle against obesity, says Benjamin Rokholm at the University of Copenhagen's Institute of Preventive Medicine in Denmark, who co-authored the review. "The most important message is that the obesity epidemic is not reversing," he says. "We've never had so many obese people in the world, so the plateauing should not be a soothing message."

We've never had so many obese people in the world, so the plateauing should not be a soothing message

Still, it will be for some: Rokholm has found that levels of obesity are actually decreasing in some countries, most notably in Japan. Boys are getting marginally lighter in Denmark, too, with the proportion of overweight and obese girls declining slightly in England, from 20.5 per cent in 2002 to 19.4 per cent in 2007.

These figures should not be taken at face value, though, argues Tim Cole at University College London. He says the overall flattening trend hides the true picture. Cole's analysis of 5-to-10-year-olds in England found that overall there was indeed a levelling off, but that rates between rich and poor were diverging. "If you separate out the data, you see that trends are still upwards in lower socioeconomic groups, but down in higher

socioeconomic groups, so they balance each other out to give the overall plateau," he says (*International Journal of Obesity*, DOI: 10.1038/ijo.2009.217).

Cole worries that rates will eventually stabilise in richer children but will continue to rise in poorer children to the point where overall rates in England will start rising again.

Some countries appear to have been more successful. In France, for example, rates have stabilised in both rich and poor children, although rates in the poorer children lagged about three years behind their wealthier peers. This success is being attributed to an aggressive anti-obesity drive that kicked off in 2001. "We think our National Nutrition and Health Programme was very helpful," says Marie Rolland-Cachera at the Centre for Research in Human Nutrition in Paris.

In the US too, health professionals are seeing their nation's stabilisation as evidence that health messages are getting through, although a recent report by the Robert Wood Johnson Foundation in Princeton, New Jersey - entitled "F as in Fat" - noted that one-third of American children aged 10 to 17 are obese or overweight. "I hope we're turning a corner, but I'd prefer to see us getting leaner," says Joe Thompson, director of the RWJF's Center to Prevent Childhood Obesity in Little Rock, Arkansas. Thompson also said that, as in England, obesity rates are disproportionately high in economically disadvantaged and some ethnic groups, so these groups are being targeted with extra resources.

So while it is good news for some, it is also clear that deeper analysis is needed and that the battle against obesity is far from won.

http://www.newscientist.com/article/mg20727723.800-rise-in-childhood-obesity-is-slowing-worldwide.html

MRI scans could diagnose autism

- Updated 16:39 12 August 2010 by **Helen Thomson**
- Magazine issue 2773.

Ten minutes in a brain scanner could be all it takes to diagnose autism. So says Christine Ecker at the Institute of Psychiatry, UK, who has developed software that identifies the anatomical signatures of the condition.

Ecker's team carried out MRI scans on the brains of 20 adult males with autism, 20 with attention-deficit disorder and 20 healthy controls. They used a machine-learning tool called a support vector machine (SVM) – which analyses data and identifies patterns – to identify key differences between the groups, such as in the cortical folding and curvature of the brain.

The SVM was then used to build a model to predict whether brain scans fall into the autistic or control group. When the original scans were fed into this model, it diagnosed autism with a 90 per cent success rate.

Current diagnosis tools are based on time-consuming and potentially stressful behavioural tests and interviews. Ecker now plans to test her model on children, for whom she predicts more accurate results "because the differences in anatomy between the healthy and autistic brain are more prominent in childhood".

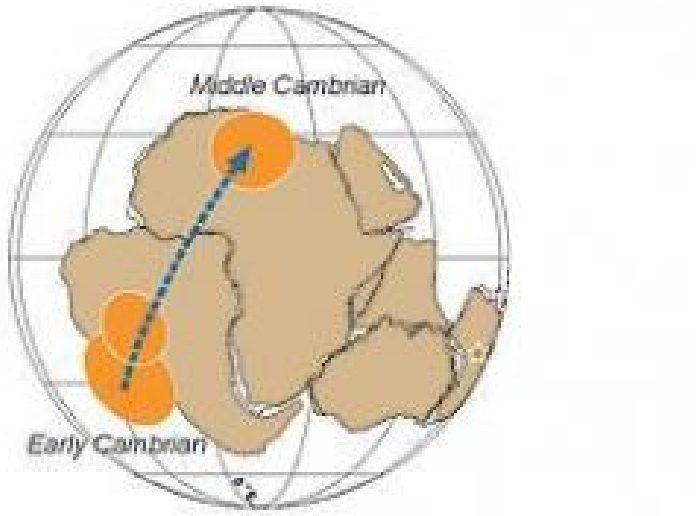
"The authors have been very careful to use this tool on a very specific group, and are not claiming that it will work on the whole spectrum of autism," says Uta Frith at University College London. "This is just the beginning, a proof of concept. It would be necessary to try it out on a new group and see whether the same results would be obtained."

She adds that studying brain anatomy alone is not enough: "We need to understand how the differences in anatomy are somehow bound up with functional differences in mental life, in how people think and feel."

Journal reference: *Journal of Neuroscience*, DOI: 10.1523/jneurosci.5413-09.2010

http://www.newscientist.com/article/dn19291-mri-scans-could-diagnose-autism.html

Gondwana Supercontinent Underwent Massive Shift During Cambrian Explosion



The paleomagnetic record from the Amadeus Basin in Australia (marked by the star) indicate a large shift in some parts of the Gondwana supercontinent relative to the South Pole. (Credit: Illustration by Ross Mitchell/Yale University)

ScienceDaily (Aug. 11, 2010) — The Gondwana supercontinent underwent a 60-degree rotation across Earth's surface during the Early Cambrian period, according to new evidence uncovered by a team of Yale University geologists. Gondwana made up the southern half of Pangaea, the giant supercontinent that constituted the Earth's landmass before it broke up into the separate continents we see today.

The study, which appears in the August issue of the journal *Geology*, has implications for the environmental conditions that existed at a crucial period in Earth's evolutionary history called the Cambrian explosion, when most of the major groups of complex animals rapidly appeared.

The team studied the paleomagnetic record of the Amadeus Basin in central Australia, which was part of the Gondwana precursor supercontinent. Based on the directions of the ancient rock's magnetization, they discovered that the entire Gondwana landmass underwent a rapid 60-degree rotational shift, with some regions attaining a speed of at least 16 (+12/-8) cm/year, about 525 million years ago. By comparison, the fastest shifts we see today are at speeds of about four cm/year.

This was the first large-scale rotation that Gondwana underwent after forming, said Ross Mitchell, a Yale graduate student and author of the study. The shift could either be the result of plate tectonics (the individual motion of continental plates with respect to one another) or "true polar wander," in which the Earth's solid land mass (down to the liquid outer core almost 3,000 km deep) rotates together with respect to the planet's rotational axis, changing the location of the geographic poles, Mitchell said.

The debate about the role of true polar wander versus plate tectonics in defining the motions of Earth's continents has been going on in the scientific community for decades, as more and more evidence is gathered, Mitchell said.

In this case, Mitchell and his team suggest that the rates of Gondwana's motion exceed those of "normal" plate tectonics as derived from the record of the past few hundred million years. "If true polar wander caused the shift, that makes sense. If the shift was due to plate tectonics, we'd have to come up with some pretty novel explanations."

Whatever the cause, the massive shift had some major consequences. As a result of the rotation, the area that is now Brazil would have rapidly moved from close to the southern pole toward the tropics. Such large movements of landmass would have affected environmental factors such as carbon concentrations and ocean levels, Mitchell said.

"There were dramatic environmental changes taking place during the Early Cambrian, right at the same time as Gondwana was undergoing this massive shift," he said. "Apart from our understanding of plate tectonics and true polar wander, this could have had huge implications for the Cambrian explosion of animal life at that time."

Other authors of the paper include David Evans and Taylor Kilian.

Story Source:

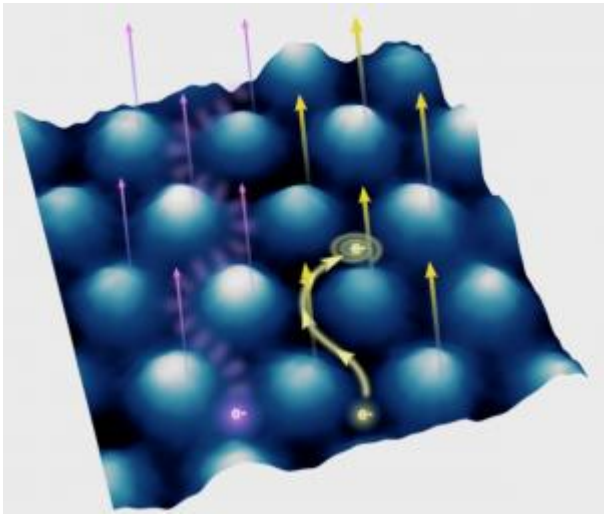
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Yale University**.

Journal Reference:

1. R. N. Mitchell, D. A. D. Evans, T. M. Kilian. **Rapid Early Cambrian rotation of Gondwana**. *Geology*, 2010; 38 (8): 755 DOI: 10.1130/G30910.1

http://www.sciencedaily.com/releases/2010/08/100810163456.htm

Electron Transport: Study of Electron Orbits in Multilayer Graphene Finds Unexpected Energy Gaps



This graphic shows electrons that move along an equipotential, while those that follow closed equipotentials (as in a potential-energy valley) become localized (right). The arrows denote the magnetic field, while hills and valleys are small potential fluctuations. (Credit: Courtesy of Phillip First)

ScienceDaily (Aug. 11, 2010) — Researchers have taken one more step toward understanding the unique and often unexpected properties of graphene, a two-dimensional carbon material that has attracted interest because of its potential applications in future generations of electronic devices.

In the Aug. 8 advance online edition of the journal *Nature Physics*, researchers from the Georgia Institute of Technology and the National Institute of Standards and Technology (NIST) describe for the first time how the orbits of electrons are distributed spatially by magnetic fields applied to layers of epitaxial graphene.

The research team also found that these electron orbits can interact with the substrate on which the graphene is grown, creating energy gaps that affect how electron waves move through the multilayer material. These energy gaps could have implications for the designers of certain graphene-based electronic devices.

"The regular pattern of energy gaps in the graphene surface creates regions where electron transport is not allowed," said Phillip N. First, a professor in the Georgia Tech School of Physics and one of the paper's co-authors. "Electron waves would have to go around these regions, requiring new patterns of electron wave interference. Understanding such interference will be important for bi-layer graphene devices that have been proposed, and may be important for other lattice-matched substrates used to support graphene and graphene devices."

In a magnetic field, an electron moves in a circular trajectory -- known as a cyclotron orbit -- whose radius depends on the size of the magnetic field and the energy of electron. For a constant magnetic field, that's a little like rolling a marble around in a large bowl, First said.

"At high energy, the marble orbits high in the bowl, while for lower energies, the orbit size is smaller and lower in the bowl," he explained. "The cyclotron orbits in graphene also depend on the electron energy and

the local electron potential -- corresponding to the bowl -- but until now, the orbits hadn't been imaged directly."

Placed in a magnetic field, these orbits normally drift along lines of nearly constant electric potential. But when a graphene sample has small fluctuations in the potential, these "drift states" can become trapped at a hill or valley in the material that has closed constant potential contours. Such trapping of charge carriers is important for the quantum Hall effect, in which precisely quantized resistance results from charge conduction solely through the orbits that skip along the edges of the material.

The study focused on one particular electron orbit: a zero-energy orbit that is unique to graphene. Because electrons are matter waves, interference within a material affects how their energy relates to the velocity of the wave -- and reflected waves added to an incoming wave can combine to produce a slower composite wave. Electrons moving through the unique "chicken-wire" arrangement of carbon-carbon bonds in the graphene interfere in a way that leaves the wave velocity the same for all energy levels.

In addition to finding that energy states follow contours of constant electric potential, the researchers discovered specific areas on the graphene surface where the orbital energy of the electrons changes from one atom to the next. That creates an energy gap within isolated patches on the surface.

"By examining their distribution over the surface for different magnetic fields, we determined that the energy gap is due to a subtle interaction with the substrate, which consists of multilayer graphene grown on a silicon carbide wafer," First explained.

In multilayer epitaxial graphene, each layer's symmetrical sublattice is rotated slightly with respect to the next. In prior studies, researchers found that the rotations served to decouple the electronic properties of each graphene layer.

"Our findings hold the first indications of a small position-dependent interaction between the layers," said David L. Miller, the paper's first author and a graduate student in First's laboratory. "This interaction occurs only when the size of a cyclotron orbit -- which shrinks as the magnetic field is increased -- becomes smaller than the size of the observed patches."

The origin of the position dependent interaction is believed to be the "moiré pattern" of atomic alignments between two adjacent layers of graphene. In some regions, atoms of one layer lie atop atoms of the layer below, while in other regions, none of the atoms align with the atoms in the layer below. In still other regions, half of the atoms have neighbors in the underlayer, an instance in which the symmetry of the carbon atoms is broken and the Landau level -- discrete energy level of the electrons -- splits into two different energies.

Experimentally, the researchers examined a sample of epitaxial graphene grown at Georgia Tech in the laboratory of Professor Walt de Heer, using techniques developed by his research team over the past several years.

They used the tip of a custom-built scanning-tunneling microscope (STM) to probe the atomic-scale electronic structure of the graphene in a technique known as scanning tunneling spectroscopy. The tip was moved across the surface of a 100-square nanometer section of graphene, and spectroscopic data was acquired every 0.4 nanometers.

The measurements were done at 4.3 degrees Kelvin to take advantage of the fact that energy resolution is proportional to the temperature. The scanning-tunneling microscope, designed and built by Joseph Stroscio at NIST's Center for Nanoscale Science and Technology, used a superconducting magnet to provide the magnetic fields needed to study the orbits.

According to First, the study raises a number of questions for future research, including how the energy gaps will affect electron transport properties, how the observed effects may impact proposed bi-layer graphene coherent devices -- and whether the new phenomenon can be controlled.

"This study is really a stepping stone in long path to understanding the subtleties of graphene's interesting properties," he said. "This material is different from anything we have worked with before in electronics."

In addition to those already mentioned, the study also included Walt de Heer, Kevin D. Kubista, Ming Ruan, and Markus Kinderman from Georgia Tech and Gregory M. Rutter from NIST. The research was supported by the National Science Foundation, the Semiconductor Research Corporation and the W.M. Keck Foundation. Additional assistance was provided by Georgia Tech's Materials Research Science and Engineering Center (MRSEC).

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Georgia Institute of Technology Research News**. The original article was written by John Toon.

Journal Reference:

1. David L. Miller, Kevin D. Kubista, Gregory M. Rutter, Ming Ruan, Walt A. de Heer, Markus Kindermann, Phillip N. First, Joseph A. Stroscio. **Real-space mapping of magnetically quantized graphene states**. *Nature Physics*, 2010; DOI: 10.1038/nphys1736

http://www.sciencedaily.com/releases/2010/08/100810094623.htm

Deployment of Buoys to Measure Air and Sea Interactions in Typhoons Launched from Taiwan

An international team of scientists from the University of Miami, the University of Leeds, WHOI, and Environment Canada are participating in a groundbreaking study to help better understand interactions between the ocean and atmosphere during typhoons. The researchers are using a boat-shaped EASI (Extreme Air-Sea Interaction) buoy and an ASIS (Air-Sea Interaction Spar) buoy to gather data. The project is being funded by the US Office of Naval Research. (Credit: Hans Graber/UM)

ScienceDaily (Aug. 11, 2010) — An international team of scientists and technicians from the University of Miami (UM) Rosenstiel School, the University of Leeds in the United Kingdom, Woods Hole Oceanographic Institution, and Environment Canada are participating in a groundbreaking buoy deployment that will help them to better understand interactions between the ocean and atmosphere during typhoons. The research is funded by the U.S. Office of Naval Research.

The R/V Revelle, a Scripps research vessel departed from the port of Kao-hsiung, Taiwan with two tandem buoy sets onboard: the boat-shaped EASI (Extreme Air-Sea Interaction) buoy and the ASIS (Air-Sea Interaction Spar) buoy. This is the first time these buoys will be used in the typhoon-prone Western Pacific. In the past, these buoy deployments have taken place in the Atlantic Ocean during hurricane season, and on separate experiments in the Southern Ocean and Labrador Sea.

The researchers are deploying the two sets of buoys in tandem, about 450 miles southeast of Taiwan to thoroughly test them in typhoon force conditions. The buoys will be out at sea for 3 months collecting valuable data that scientists will use to understand the exchange dynamics and fluxes occurring between the atmosphere and ocean during the intense typhoon conditions.

"We have successfully used these buoys to measure air-sea interactions and wave dynamics in the Atlantic in a variety of storm conditions and are now looking forward to applying this technology to the western Pacific where super typhoons develop quite frequently," said the PI of this project, Dr. Hans Graber, professor and executive director of UM's Center for Southeastern Tropical Advanced Remote Sensing. "In the last several years we have added new technologies and improved the data collection capabilities of these buoys as well as made the buoys more robust to withstand extreme weather conditions. In addition we will also be using satellite telecommunications to query the buoys routinely from Miami and retrieve data. "

The buoys will measure the momentum, heat, and moisture exchange between the air atmosphere and ocean at the midst of tropical cyclones. This information will help improve weather forecast models that predict typhoon intensity. It will also give the research community a better idea of the distribution of wind and how force is distributed. There will be sonic anemometers (acoustic devices that measure wind speed and stress at high resolution) and a suite of other sensors that measure air temperature, humidity, and water temperature. The buoys will also have ADCPs (acoustic Doppler current profilers) to measure currents as a function of depth, as well as temperature probes in the upper ocean and acoustic devices to measure turbulence near the surface. A strong set of piano-like wires arranged in a pentagon will measure small scale details of the ocean surface (roughness) and the directional properties of waves.

"The buoys feature a Compact Lightweight Aerosol Spectrometer (CLASP) device that measures the near-surface marine aerosol production mechanisms, or sea spray from wave-breaking events that result from typhoon force winds," said Dr. Will Drennan, UM professor and associate dean of undergraduate studies for the Rosenstiel School. "These measurements could be especially important as the spray layer has a significant impact on the drag coefficient, a key parameter used in creating weather forecast models."

The team includes several people from UM, including applied marine physics professors Hans Graber and Will Drennan, associate scientist Neil Williams, marine technician Mike Rebozo, post-doctoral researchers Rafael Ramos and Michelle Gierach, graduate students Björn Lund, Henry Potter, Tripp Collins and Sharein El-Tourky, and undergraduate Marine Science student Anibal Herrera. They are joined by Joe Gabriele and Cary Smith of Environment Canada, John Kemp, Jim Dunn and Jim Ryder of Woods Hole Oceanographic Institution and Dr. Ian Brooks of the University of Leeds, UK.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Miami Rosenstiel School of Marine & Atmospheric Science**.

http://www.sciencedaily.com/releases/2010/08/100810131624.htm

Evolutionary Surprise: Freedom of Neck Played Major Role in Human Brain Evolution, Research Suggests

X-ray of a human head showing a example of contortion: the neck bending back and forward. (Credit: iStockphoto/Max Delson Martins Santos)

ScienceDaily (Aug. 11, 2010) — By deciphering the genetics in humans and fish, scientists now believe that the neck -- that little body part between your head and shoulders -- gave humans so much freedom of movement that it played a surprising and major role in the evolution of the human brain, according to New York University and Cornell University neuroscientists in the online journal *Nature Communications* (July 27, 2010.)

Scientists had assumed the pectoral fins in fish and the forelimbs (arms and hands) in humans are innervated -- or receive nerves -- from the exact same neurons. After all, the fins on fish and the arms on humans seem to be in the same place on the body. Not so.

During our early ancestors' transition from fish to land-dwellers that gave rise to upright mammals, the source for neurons that directly control the forelimbs moved from the brain into the spinal cord, as the torso moved away from the head and was given a neck. In other words human arms, like the wings of bats and birds, became separate from the head and placed on the torso below the neck.

"A neck allowed for improved movement and dexterity in terrestrial and aerial environments," says Andrew Bass, Cornell professor of neurobiology and behavior, and an author on the paper. "This innovation in biomechanics evolved hand-in-hand with changes in how the nervous system controls our limbs."

Bass explained that this unexpected level of evolutionary plasticity likely accounts for the incredible range of forelimb abilities -- from their use in flight by birds to swimming by whales and dolphins, and playing piano for humans.

The research was authored by Leung-Hang Ma (first author) and Robert Baker (corresponding author), both of Department of Physiology and Neuroscience, New York University Langone Medical Center; Edward Gilland, Department of Anatomy, Howard University; and Bass. All four researchers are affiliated with the Marine Biological Laboratory, Woods Hole, Mass.

The National Institutes of Health and the National Science Foundation funded the research.

Story Source:

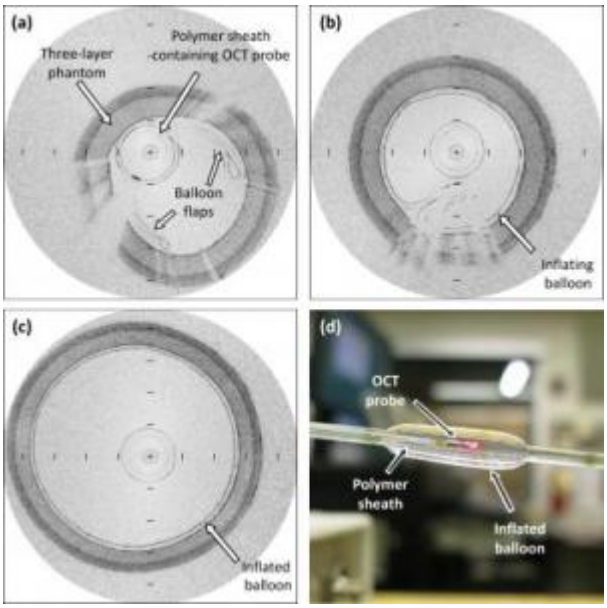
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Cornell University**.

Journal Reference:

1. Leung-Hang Ma, Edwin Gilland, Andrew H. Bass, Robert Baker. **Ancestry of motor innervation to pectoral fin and forelimb**. *Nature Communications*, 2010; DOI: 10.1038/ncomms1045

http://www.sciencedaily.com/releases/2010/07/100727112833.htm

Optical Imaging Technique for Angioplasty



Cross-sectional imaging of how balloon inflation in a three-layer phantom mimics a coronary artery. These images show different balloon inflation pressure: a.) partially folded balloon without pressure, b.) partially inflated balloon, c.) an inflated balloon, and d.) OCT probe rotating within a balloon (no phantom), the red dot indicates where the light beam exits the probe. Note: Imaging is performed with infrared light, but visible light is coupled in the system to ease identifying probe location. (Credit: American Institute of Physics)

ScienceDaily (Aug. 11, 2010) — A new optical imaging technique described in the journal *Review of Scientific Instruments*, which is published by the American Institute of Physics, holds the potential to greatly improve angioplasty, a surgery commonly performed to treat patients with a partially or completely blocked coronary artery that restricts blood flow to the heart.

Angioplasty involves threading a slender, balloon-tipped tube from an artery in the groin to the trouble spot in the artery of the heart. The balloon is then inflated to compress the plaque that is blocking the artery. These balloons can also be used to deploy a stent, which is a wire-mesh tube sometimes inserted into the artery during an angioplasty procedure to keep it open and prevent reblockage.

In both cases, an optimal balloon design is critical to the success of an operation. Balloons can now be tested in a balloon deployment tester equipped with a system to monitor the outer diameter of the balloon, according to Guy Lamouche, research officer at the National Research Council of Canada.

With the goal of improving balloon deployment, the researchers investigated obtaining a more precise monitoring of balloon inflation by combining a deployment tester with an optical coherence tomography (OCT) imaging system. OCT allows imaging over a depth of a few millimeters in a tissue or material. By performing a pullback (rotation and translation) of a catheter OCT probe in a balloon, they discovered that it's possible to obtain a precise measurement of the balloon's diameter and thickness over the entire balloon.

"Combining OCT with a balloon deployment system provides an improved platform for angioplasty balloon development and can also be used in the development of next-generation minimally invasive devices for percutaneous -- through the skin -- coronary interventions," says Lamouche. "It's now possible to monitor balloon inflation within an artery phantom (model) or an excised artery to assess the efficiency of innovative balloon angioplasty or stent deployment procedures."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Institute of Physics**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Hamed Azarnoush, Sebastien Vergnole, Rafik Bourezak, Benoit Boulet, and Guy Lamouche. **Optical coherence tomography monitoring of angioplasty balloon inflation in a deployment tester**. *Review of Scientific Instruments*, 2010; 81 (8): 083101 DOI: 10.1063/1.3465556

http://www.sciencedaily.com/releases/2010/08/100810122049.htm

New Sensor Technology to Make It Easier and Safer for Spacecraft to Rendezvous and Dock to International Space Station

STORRM docking target. (Credit: NASA/JSC)

ScienceDaily (Aug. 11, 2010) — It was a perfect STORRM. On Tuesday, July 20, NASA and its industry partners Lockheed Martin Space Systems and Ball Aerospace & Technologies Corp., successfully demonstrated a new sensor technology that will make it easier and safer for spacecraft to rendezvous and dock to the International Space Station.

This new docking navigation system prototype consists of an eye-safe lidar Vision Navigation Sensor, or VNS, a high-definition docking camera, as well as the avionics and flight software. Both sensors will provide real-time three-dimensional images to the crew with a resolution 16 times higher than the current space shuttle sensors. This next generation system also provides data from as far away as three miles -- three times the range of the current shuttle navigation sensor.

"You are looking at the future of rendezvous and docking right here," said David L. Taylor, president and CEO of Ball Aerospace, as he welcomed dozens of NASA and industry engineers to the demonstration.

The hardware will be tested by astronauts aboard STS-134, the last planned shuttle mission, currently scheduled for February 2011, as part of the Sensor Test for Orion Relative Navigation Risk Mitigation (STORRM) Development Test Objective (DTO). On Flight Day 11 of the mission, the shuttle crew will conduct an unprecedented on-orbit maneuver; they will undock from the space station and then re-rendezvous with the station on an Orion-like approach.

Five retro-reflectors, which will serve as targets for the VNS, were installed on the station's visual docking target during the STS-131 shuttle mission in May.

The demonstration, held at Ball Aerospace in Boulder, Colo. offered the STORRM team the chance to operate the flight hardware for personnel who will be supporting STORRM during the mission -- the astronaut crew, flight director, and mission operations personnel.

Mark Kirasich, deputy Orion Manager from the Orion Project Office at NASA's Johnson Space Center in Houston recognized the STORRM team for its perseverance and dedication to develop the DTO flight hardware on an aggressive and success-oriented schedule.

The intense project required NASA engineers and contractors to work holidays, evenings and weekends in order to successfully deliver the DTO flight hardware per the shuttle schedule. Normally, it takes more than two years to develop flight hardware, but the STORRM team was able to deliver the DTO sensor hardware in half that time. Despite the aggressive schedule, the team finished on time.

"It's been challenging -- but we were successful," said Frank Novak, STORRM project manager from NASA's Langley Research Center. "We were successful despite many challenges; my hat's off to the team."

"We have met every milestone along the way, and I could not be more proud of this team," echoed Howard Hu, manager of Orion Vehicle Performance and Analysis, responsible for STORRM from NASA Johnson.

Following the demonstration, the STS-134 crew was briefed on the STORRM hardware and mission objectives. After the hardware demonstration, the STORRM avionics lead Tom Johnson from NASA Langley and the Deputy Principal Investigator Sean Maguire from NASA Johnson, led the crew training activities, which gave crewmember Andrew Feustel and Commander Mark Kelly "hands on" time to gain experience running the software application and the STORRM flight hardware.

"I've been to the space station three times, and this is the first time that I'll be doing something like this," said Kelly, who will serve as commander on STS-134.

On Aug. 3, the STORRM hardware will be shipped to NASA's Kennedy Space Center where it will be integrated into the shuttle.

"This is a huge step forward for us," said Kirasich. "You saw Pad Abort-1. This is the next big thing."

STORRM was developed by the Orion Project Office at NASA Johnson, which is responsible for program management, technology evaluation, flight test objectives, operational concepts, contract management and data post-processing. Engineers at NASA Langley were responsible for engineering management, design and build of the avionics, STORRM software application and reflective elements. They are also responsible for the integration, testing and certification of these components. Industry partners Lockheed Martin Space Systems and Ball Aerospace Technologies Corp. were responsible for the design, build and testing of the VNS and docking camera.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA**.

http://www.sciencedaily.com/releases/2010/08/100810083437.htm

Common Orchid Gives Scientists Hope in Face of Climate Change

Dactylorhiza traunsteineri in Yorkshire, England. (Credit: Photo by Dr. Ovidiu Paun)

ScienceDaily (Aug. 10, 2010) — A study led by scientists from the Royal Botanic Gardens, Kew's Jodrell Laboratory, which focuses on epigenetics in European common marsh orchids, has revealed that some plants may be able to adapt more quickly to environmental change than previously thought. The research, published in *Molecular Biology and Evolution*, brings new hope to plant conservation.

Epigenetics comprises hidden influences upon gene functions that occur without a change in the DNA sequence, but are potentially inheritable, and it is a new field of research that is reshaping the way scientists look at the living world. This new evidence that environmental effects on gene activity can be 'remembered' is hugely significant. In the modern interpretation of Darwin's theory of evolution, scientists previously thought that genetic mutations (permanent changes in DNA sequence) were the only source of new traits that could be handed down from generation to generation, causing changes to the way species react to their environment. This process of adaptation can take hundreds of years and is almost certainly too slow for plants to adapt to rapid climate change.

However, in this cutting-edge study on a group of marsh orchids, Kew scientists have found that epigenetic variation can significantly influence the adaptive potential of an individual species. In turn, this affects the evolutionary potential of a species at a much quicker rate than was previously thought.

This study focused on three recently formed species of delicate purple European marsh-orchids (Dactylorhiza) of hybrid origin, two of them occurring in the UK. Despite having a highly similar genetic heritage, the three orchids differ considerably in ecological requirements, morphology, physical characteristics and distribution.

Dr Ovidiu Paun, lead researcher says, "In contrast to the genetic information, which is a more "closed" system, the environment can alter the epigenetic context of individual species, and this adaptive pathway is complementary to the currently accepted view on evolution. The results in the paper demonstrate that Darwinian selection acts on epigenetic variation in the same way as on the genetic information to result in adaptation and divergence between species within a small number of generations."

He continues, "Our results show the importance of the environment in altering inherited traits in these orchids and also contributing to biodiversity. The epigenetic level of natural variation can be adaptive and has the potential to be rapidly released, in a few generations, in contrast to genetic variation."

Adds Professor Mark Chase, Keeper of Kew's Jodrell Laboratory," Our results are particularly relevant in the present context of widespread environmental challenges and give us more hope in the adaptive potential of organisms. It is not instantaneous, but it is much faster than what we thought previously.

"However, this also means that ex-situ conservation of threatened species, when individuals are removed from their original environment and are usually relocated to a botanical garden, is not the best strategy for their preservation, as it may delete any intrinsic epigenetic specificity. A much better solution remains their conservation in the wild."

Story Source:

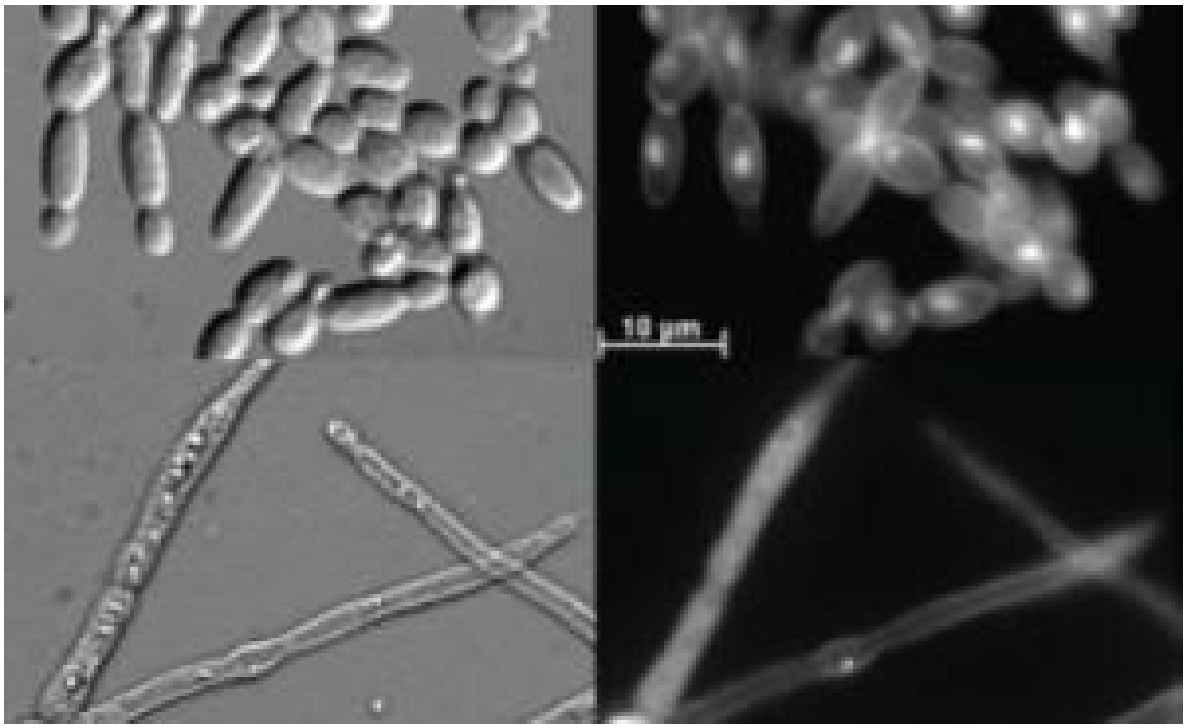
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Royal Botanic Gardens Kew**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. O. Paun, R. M. Bateman, M. F. Fay, M. Hedren, L. Civeyrel, M. W. Chase. **Stable epigenetic effects impact adaptation in allopolyploid orchids (Dactylorhiza: Orchidaceae)**. *Molecular Biology and Evolution*, 2010; DOI: 10.1093/molbev/msq150

http://www.sciencedaily.com/releases/2010/08/100810094615.htm

Vitamin B3 as a Novel Approach to Treat Fungal Infections



A team of scientists from the Institute for Research in Immunology and Cancer of the University of Montreal have identified vitamin B3 as a potential antifungal treatment. (Credit: Institute for Research in Immunology and Cancer (IRIC) of the University of Montreal)

ScienceDaily (Aug. 10, 2010) — A team of scientists from the Institute for Research in Immunology and Cancer (IRIC) of the University of Montreal have identified vitamin B3 as a potential antifungal treatment.

Led by IRIC Principal Investigators Martine Raymond, Alain Verreault and Pierre Thibault, in collaboration with Alaka Mullick, from the Biotechnology Research Institute of the National Research Council Canada, the study is the subject of a recent article in *Nature Medicine*.

Infections by the yeast Candida albicans represent a significant public health problem and a common complication in immunodeficient individuals such as AIDS patients, cancer patients undergoing chemotherapy and recipients of organ transplants. While some treatments are available, their efficacy can be compromised by the emergence of drug-resistant strains.

The current study shows that a C. albicans enzyme, known as Hst3, is essential to the growth and survival of the yeast. Researchers found that genetic or pharmacological inhibition of Hst3 with nicotinamide, a form of vitamin B3, strongly reduced C. albicans virulence in a mouse model. Both normal and drug-resistant strains of C. albicans were susceptible to nicotinamide. In addition, nicotinamide prevented the growth of other pathogenic Candida species and Aspergillus fumigatus (another human pathogen), thus demonstrating the broad antifungal properties of nicotinamide.

"There is an urgent need to develop new therapies to kill C. albicans because it is one of the leading causes of hospital-acquired infections and is associated with high mortality rates," explains Martine Raymond, who is also a professor at the University of Montreal Department of Biochemistry. "Although many issues remain to be investigated, the results of our study are very exciting and they constitute an important first step in the development of new therapeutic agents to treat fungal infections without major side effects for patients."

Martine Raymond is Principal Investigator in the Yeast Molecular Biology Laboratory. Alain Verreault is Principal Investigator in the Chromosome Biogenesis Laboratory. Pierre Thibault is Principal Investigator in the Proteomics and Bioanalytical Mass Spectrometry Laboratory. The research received funding from the Canadian Institutes for Health Research and the National Science and Engineering Research Council of Canada.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Montreal**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Hugo Wurtele, Sarah Tsao, Guylaine Lépine, Alaka Mullick, Jessy Tremblay, Paul Drogaris, Eun-Hye Lee, Pierre Thibault, Alain Verreault, Martine Raymond. **Modulation of histone H3 lysine 56 acetylation as an antifungal therapeutic strategy**. *Nature Medicine*, 2010; 16 (7): 774 DOI: 10.1038/nm.2175

http://www.sciencedaily.com/releases/2010/07/100708141617.htm

Mosasaur Fossil: Life of 85-Million-Year-Old 'Sea Monster' Illuminated

One of the ocean's most formidable marine predators, the mosasaur Platecarpus, lived in the Cretaceous Period some 85 million years ago and was thought to have swum like an eel. Mosasaurs were lizard-like in appearance and known for their ferociousness. (Credit: Illustration by Stephanie Abramowciz, NHM Dinosaur Institute)

ScienceDaily (Aug. 10, 2010) — One of the ocean's most formidable marine predators, the marine mosasaur *Platecarpus*, lived in the Cretaceous Period some 85 million years ago and was thought to have swum like an eel. That theory is debunked in a new paper published August 10 in the journal *PLoS ONE*. An international team of scientists have reconceived the animal's morphology, or body plan, based on a spectacular specimen housed at the Natural History Museum of Los Angeles County.

The paper was co-authored by a team of four scientists: Johan Lindgren (Lund University, Lund, Sweden), Michael W. Caldwell, Takuya Konishi (University of Alberta, Edmonton, Alberta, Canada), and Luis M. Chiappe, Director of the Natural History Museum's Dinosaur Institute.

The mosasaur specimen was discovered in Kansas in 1969, and acquired by the NHM shortly thereafter. It contains four slabs, which make up a virtually complete, 20-foot specimen. Dr. Chiappe spurred a modern preparation of the specimen, and assembled the paper's research team. "It is one of several exceptional fossils that will be featured in Dinosaur Mysteries," said Chiappe, curator of the 15,000-square foot landmark exhibition that opens at the museum in 2011.

In the meantime, the fossil will be temporarily on display at the museum's Dino Lab, a working lab located on the second floor of the museum, where paleontologists prepare fossils in full view of the public.

The specimen is "the finest preserved mosasaur in existence," according to Dr. Johan Lindgren, lead author of the published study. It retains traces of a partial body outline, putative skin color markings, external scales, a downturned tail, branching bronchial tubes, and stomach contents (fish).

Using it, the scientists demonstrate that a streamlined body plan and crescent-shaped tail fin were already well established in *Platecarpus*, and that these key features evolved very early in the evolution of mosasaurs. Noting the highly specialized tail fin, the new study assert that mosasaurs were better swimmers than previously thought -- and that they swam more like sharks than eels.

The findings underscore how these adaptations for fully aquatic existence evolved rapidly and convergently in several groups of Mesozoic marine reptiles, as well as in extant whales. "This fossil shows evolution in action, how a successful design was developed time after time by different groups of organisms adapting to life in similar environments," said Chiappe. "It highlights once again the potential for new discoveries to challenge well-established interpretations about dinosaurs and other animals that lived with them."

"From this beautifully preserved specimen it seems that advanced, shark like swimming began in mosasaurs millions of years earlier than we previously thought," said Dr. Kevin Padian, a paleontologist at the University of California, Berkeley, not involved in the paper. "This study is the best possible proof that active research by curators and staff is the most essential component of a museum dedicated to educating the public."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Natural History Museum of Los Angeles County**.

Journal Reference:

1. Johan Lindgren, Michael W. Caldwell, Takuya Konishi, Luis M. Chiappe, Andrew Allen Farke. **Convergent Evolution in Aquatic Tetrapods: Insights from an Exceptional Fossil Mosasaur**. *PLoS ONE*, 2010; 5 (8): e11998 DOI: 10.1371/journal.pone.0011998

http://www.sciencedaily.com/releases/2010/08/100810101732.htm

Polar Bears, Glaucous Gulls Most at Risk from Contaminants

Polar bears in Svalbard and East Greenland are most at risk from the effects of contaminants such as PCBs and DDT, which are found in the Arctic. (Credit: Photo courtesy of the USGS NBII)

ScienceDaily (Aug. 10, 2010) — Although animals throughout the Arctic are exposed to an alphabet soup of pollutants and contaminants that are carried north from industrialized countries, only polar bears in East Greenland and Svalbard and glaucous gulls in Svalbard appear to be showing any deleterious effects, according to a new report co-authored by a researcher from the Norwegian University of Science and Technology.

The summary, which is part of a comprehensive effort called the Arctic Monitoring and Assessment Programme (AMAP), was published in a recent special issue of Science of the Total Environment. Bjørn Munro Jenssen, a professor of biology at NTNU, was one of the authors of the summary, which reports in part on his work with polar bears on Svalbard.

While researchers could not document strong evidence that contaminants such as PCBs and DDT were adversely affecting animals throughout the Arctic, other factors, such as the impact of climate change, disease and the invasion of new species will affect the overall exposure that each animal has to pollutants. Climate change, in particular, will affect sea ice distribution and temperatures. This will in turn cause food web changes and changes in nutrition, which led the researchers to list animals at the highest risk from contaminant exposure.

The Arctic wildlife and fish considered to be most at risk are: Polar bears in East Greenland, Svalbard and Hudson Bay, killer whales in Alaska and northern Norway, several species of gulls and other seabirds from the Svalbard area, northern Norway, East Greenland, the Kara Sea, and the Canadian central high Arctic, ringed seals from East Greenland, and a few populations of Arctic char and Greenland shark.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **The Norwegian University of Science and Technology (NTNU)**, via AlphaGalileo.

Journal Reference:

1. Robert J. Letcher, Jan Ove Bustnes, Rune Dietz, Bjørn M. Jenssen, Even H. Jørgensen, Christian Sonne, Jonathan Verreault, Mathilakath M. Vijayan, Geir W. Gabrielsen. **Exposure and effects assessment of persistent organohalogen contaminants in arctic wildlife and fish%u2606**. *Science of The Total Environment*, 2010; 408 (15): 2995 DOI: 10.1016/j.scitotenv.2009.10.038

http://www.sciencedaily.com/releases/2010/08/100809133241.htm

Stone Age Remains Are Britain's Earliest House

Archaeologists working on Stone Age remains at a site in North Yorkshire say it contains Britain's earliest surviving house. (Credit: From an original drawing by Alan Sorrell)

ScienceDaily (Aug. 10, 2010) — The team from the Universities of Manchester and York reveal today that the home dates to at least 8,500 BC -- when Britain was part of continental Europe.

The research team unearthed the 3.5 metres circular structure next to an ancient lake at Star Carr, near Scarborough, a site comparable in archaeological importance to Stonehenge.

The team are currently excavating a large wooden platform next to the lake, made of timbers which have been split and hewn. The platform is the earliest evidence of carpentry in Europe.

A large tree trunk has also been uncovered by the team. Despite being 11,000 years old it is well preserved with its bark still intact.

The house predates what was previously Britain's oldest known dwelling at Howick, Northumberland, by at least 500 years.

Dr Chantal Conneller and Barry Taylor from The University of Manchester with Dr Nicky Milner from the University of York have been working at Star Carr since 2004.

The house, which was first excavated by the team two years ago, had post holes around a central hollow which would have been filled with organic matter such as reeds, and possibly a fireplace.

The site was inhabited by hunter gatherers from just after the last ice age, for a period of between 200 and 500 years.

According to the team, they migrated from an area now under the North Sea, hunting animals including deer, wild boar, elk and enormous wild cattle known as auroch.

Though they did not cultivate the land, the inhabitants did burn part of the landscape to encourage animals to eat shoots and they also kept domesticated dogs.

Dr Milner said: "This is a sensational discovery and tells us so much about the people who lived at this time.

"From this excavation, we gain a vivid picture of how these people lived. For example, it looks like the house may have been rebuilt at various stages.

"It is also likely there was more than one house and lots of people lived here.

"The platform is made of hewn and split timbers; the earliest evidence of this type of carpentry in Europe. And the artefacts of antler, particularly the antler head-dresses, are intriguing as they suggest ritual activities."

Dr Conneller said: "This changes our ideas of the lives of the first settlers to move back into Britain after the end of the last Ice Age.

"We used to think they moved around a lot and left little evidence. Now we know they built large structures and were very attached to particular places in the landscape."

Barry Taylor added: "The ancient lake is a hugely important archaeological landscape many miles across.

"To an inexperienced eye, the area looks unremarkable -- just a series of little rises in the landscape.

"But using special techniques I have been able to reconstruct the landscape as it was then.

"The peaty nature of the landscape has enabled the preservation of many treasures including the paddle of a boat, the tips of arrows and red deer skull tops which were worn as masks.

"But the peat is drying out, so it's a race against time to continue the work before the archaeological finds decay."

English Heritage recently entered into a management agreement with the farmers who own the land at Star Carr to help protect the archaeological remains.

Keith Emerick, English Heritage Inspector of Ancient Monuments, explained:

"We are grateful to the landowners for entering into this far reaching agreement.

"Star Carr is internationally important, but the precious remains are very fragile.

"A new excavation currently underway will tell us more about their state of preservation and will help us decide whether a larger scale dig is necessary to recover information before it is lost for ever."

The research has been made possible by a grant from the Natural Environment Research Council, early excavation funding from the British Academy, and from English Heritage who are about to schedule the site as a National Monument . The Vale of Pickering Research Trust has also provided support for the excavation works.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Manchester**.

http://www.sciencedaily.com/releases/2010/08/100810101724.htm

A Village Preserved, Green and All: Brian May's Photographic Recovery

By RANDY KENNEDY

The name T. R. Williams does not ring many bells in photohistorical circles today. But in Victorian London he was a kind of rock star, whose instruments were marvels of scientific novelty — the stereoscopic camera and viewer, developed in the 1850s, were the earliest forerunners of the View-Master and the current 3-D movie craze. His fame as a stereo portraitist reached such heights that the Queen herself requested his services, to photograph her daughter, Princess Victoria, on her 16th birthday and on the occasion of her wedding. But by the early 20th century, after movies brought an end to the form's wild popularity, the work of stereo photographers like Williams often wound up in the dusty remainder bins of photo shops and auction houses.

Which is where an actual rock star affiliated with a different sort of Queen — Brian May, the woolly-haired lead guitarist for the beloved glam-band — was perpetually on the prowl for them for years, between gigs, in many of the cities where the band was packing stadiums. "Depending on where we were, I always knew the dealers and collectors to go see," recalled Mr. May, who has been obsessed with stereo pictures for most of his life. "And it was nice because I was interacting in a world that was completely divorced from the rock world. None of these guys thought of me as anything other than an enthusiast, unless one of their kids would see me and say, 'Do you know who that is? He's in Queen!' "

Now, after more than four decades of collecting, Mr. May's passion has resulted in an ambitious door-stopper of a historical study examining Williams's life and work, "A Village Lost and Found" (Frances Lincoln). To promote the book, which Mr. May wrote with a photography historian and conservator, Elena Vidal, he has embarked on a tour considerably more sedate than the ones he used to know. Last week, one of its stops was Huron, Ohio (pop. 7,348), where he and Ms. Vidal were guest speakers at the 36th annual convention of the National Stereoscopic Association, a group of ardent hobbyists and collectors.

On Thursday the tour came to New York City, where Mr. May spoke before a modest but appreciative crowd at the Barnes & Noble branch in TriBeCa. (Only one Queen T-shirt was in evidence but an exuberant fan did bring his red electric guitar to try to get Mr. May to sign it.) On Friday Mr. May was to play undoubtedly the tour's most august venue, the Metropolitan Museum of Art, discussing "A Village Lost and Found" with Ms. Vidal as part of the museum's lecture series. In an interview at the Waldorf Astoria, where he was staying, Mr. May said that the book had been a dream of his almost since he came across his first Williams stereo-photo card — a pastel-colored rural reverie — as a college student in London and wondered "What in the world can this be?" While Williams had a thriving business producing portraits and views of notable events of the day, he seemed to have spent years working on a project much more personal in nature, a series called "Scenes in Our Village," that chronicled daily life in a tiny countryside town. The pictures in that series — with titles like "Old Dancy Enjoying His Pipe," "Little Polly Gone Fast Asleep" and "Loading the Dung Cart," and with sentimental poems, probably written by Williams himself, printed on the backs of the cards — were an attempt to capture a vision of English rural life that was already disappearing in the 1850s, as the Industrial Revolution gathered speed. The nostalgia for this kind of an idyllic past runs deep in English culture, and was memorably celebrated (and poked fun at) by another British rock band, the Kinks, in their song "The Village Green Preservation Society." ("We are the Office Block Persecution Affinity/God save little shops, china cups and virginity.")

Williams's photo cards, many of them hand-colored, present such an idealized view of that vanishing world that Mr. May and others familiar with the photographer's work were never sure whether the village they showed had actually existed, or was perhaps cobbled together from scenes in various places. But one benefit of being famous is that you can get people's attention. And so in 2003, when Mr. May posted a picture on brianmay.com of the village church shown in the stereo cards and an appeal for help in tracking down its location, he was inundated with information, and within 36 hours found the village, which was no Brigadoon. Called Hinton Waldrist, it still exists in Oxfordshire, west of London. Mr. May and Ms. Vidal have since spent a considerable amount of time there — as Williams is now known to have done as a child — and have tracked down many of the old buildings and views captured in his pictures. Asked whether he was drawn to it by countryside childhood memories of his own, Mr. May, who grew up in the London suburb of Feltham — which he called "not a pretty place" — said, smiling: "Not memories from this life, I don't think. Maybe from a previous one."

The writing life has been just one element of a highly unusual post-superstar career that Mr. May, 63, has pursued since the death of the band's lead singer, Freddie Mercury, in 1991, and the band's semiretirement of the last few years. He went back to school and took up the studies in astrophysics he had left when his music career took off in the 1970s. He earned his doctorate in 2008 and published his thesis, the title of which would not look out of place on a Pink Floyd album cover: "A Survey of Radial Velocities in the Zodiacal Dust Cloud" (Copies of the thesis are available on Amazon.com for $63.96.) He has also been a frequent guest on the popular BBC astronomy program "The Sky at Night," and serves in a ceremonial capacity as chancellor of Liverpool John Moores University. His head is still surrounded by the cloud of poodle curls he sported during his Queen years, but they have now gone a little gray, and he carries himself with more of an English gentleman's gravitas than a rocker's swagger. Two more vintage photography books are now in the works, he said, a full-length biography of Williams and an examination of wildly inventive French stereoscopic work from around the same period. While he is still involved in making music and has hinted that he and Queen's drummer, Roger Taylor, might reunite to play together again, he seems perfectly contented these days taking the stage behind a lectern, with a pair of reading glasses perched on his nose. Surveying the quietly admiring bookstore crowd in TriBeCa on Thursday night, he cleared his throat and deadpanned: "This isn't exactly Madison Square Garden, but I think it will do."

http://www.nytimes.com/2010/07/24/arts/design/24may.html?ref=design

Mimicking the Moon's Surface in the Basement

Ion Beam Materials Lab. (Credit: Image courtesy of DOE/Los Alamos National Laboratory)

ScienceDaily (Aug. 7, 2010) — A team of scientists used an ion beam in a basement room at Los Alamos National Laboratory to simulate solar winds on the surface of the Moon. The table-top simulation helped confirm that the Moon is inherently dry.

In research published in *Science* Express, Zachary Sharp of the University of New Mexico and a team of scientists from California, Texas and New Mexico -- including Yongqiang Wang, leader of Los Alamos' Ion Beam Materials Lab -- present an analysis of chlorine isotopic ratios in lunar rock samples that seem to indicate that the Moon never had water of its own.

Many scientists believe that the Moon formed when a large object collided with Earth early in its formative stages, leaving behind a blob of material that became trapped in orbit around the nascent Earth. Because most of the water on Earth likely came from water liberated from molten basalts as they cooled, researchers have often wondered whether the Moon's geology contains similar concentrations of trapped water.

Sharp and his team examined ratios of stable chlorine isotopes -- chlorine-35 and chlorine-37 -- in terrestrial and lunar rock samples. Chlorine readily interacts with hydrogen and is highly volatile. Consequently, the ratio and concentrations of these isotopes can provide a "fingerprint" of water content of volcanic rocks.

If the Moon were formed via cataclysmic collision of a foreign body with a fledgling Earth, it's reasonable to assume that lunar basalts would share a similarly soggy history as their earthen brethren. However, an analysis of the chlorine isotopic ratios of rocks from the Earth and Moon provided vastly different fingerprints. Sharp and his team came up with three possible explanations for the differences: 1) the moon-forming collision homogenized molten material from Earth and the colliding body into a material with a unique composition, 2) hydrogen-rich solar winds buffeting the moon preferentially stripped away one isotopic chlorine species from rocks, or 3) lunar basalts were inherently anhydrous.

The researchers dismissed the homogenization scenario after comparing observed chlorine isotope concentrations with other volatile elements in the basalts. The other volatile chemicals did not behave consistently with what would have been expected for the homogenization scenario.

To assess the effects of solar winds, Los Alamos researcher Wang took a thin film of sodium chloride -- the same chemical as ordinary table salt -- and bombarded it with a stream of protons (hydrogen ions) at Los Alamos' Ion Beam Materials Lab. If the rocks were to be affected by the solar winds, the lighter chlorine isotope, chlorine-35, would preferentially react with the protons and be carried away as hydrogen chloride (HCl) gas. If this scenario were true, researchers would then find slightly higher ratios of the heavier isotope in the rocks. After subjecting the sample to eons of "solar-wind" exposure, the research team found that the samples were essentially unaffected by the proton onslaught.

Furthermore, lunar rocks from the surface showed depleted values of chlorine-37 relative to the lighter chlorine-35 isotope, and subsurface lunar rock samples shielded from solar winds had higher, not lower, concentrations of chlorine-37. These findings helped dismiss the second scenario.

The research team found that the third scenario -- that the moon was inherently without water -- was supported by the lunar rock samples because the residual chlorine isotopes found in the rocks seem to have originated from metal chlorides such as sodium chloride, zinc chloride and iron chloride, which have been seen as surface coatings on lunar volcanic rocks.

With regard to scientific findings of water-ice in lunar surface samples, the likely source is from comets, not the Moon itself.

Other researchers have published papers contradicting the team's findings. Sharp says the reason behind the discrepancies in his team's research and previous research is not well understood yet, and will require further analysis.

Even though his laboratory helped simulate the moon, Los Alamos researcher Wang remains down to Earth.

"It was very gratifying to play a role in the research and to be able to exclude one argument more definitively than before," Wang said.

The research team included Sharp and Chip Shearer of the University of New Mexico; Kevin McKeegan of the University of California at Los Angeles; Jamie Barnes of the University of Texas; and Wang of Los Alamos National Laboratory.

Los Alamos National Laboratory's Ion Beam Materials Laboratory was supported by the U.S. Department of Energy's Office of Science's Office of Basic Energy Science. Further support for Los Alamos' efforts come from Los Alamos' Laboratory-Directed Research and Development program.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Los Alamos National Laboratory**.

Journal Reference:

1. Z. D. Sharp, C. K. Shearer, K. D. McKeegan, J. D. Barnes, and Y. Q. Wang. **The Chlorine Isotope Composition of the Moon and Implications for an Anhydrous Mantle**. *Science*, 2010; DOI: 10.1126/science.1192606

http://www.sciencedaily.com/releases/2010/08/100806093110.htm

Looking for the Coolest Forms of Life on Earth

Dr Liane Benning and Jennifer Eigenbrode obtaining core samples in Friedrichbreen glacier, near Bockfjorden, during the AMASE 2009 campaign. (Credit: Juan Diego Rodriguez-Blanco)

ScienceDaily (Aug. 7, 2010) — Two UK scientists are travelling to one of the coldest places on Earth to help them understand how life could exist on other planets in our Solar System.

Professor Liane Benning (University of Leeds) and Dr Dominique Tobler (University of Glasgow) are travelling to Ny-Ålesund on the island of Svalbard to investigate how the snow and ice there was first colonised by extremophiles -- organisms that thrive in harsh conditions.

The team will spend two weeks on Svalbard from 6 to 20 August as part of the Europlanet Research Infrastructure's Transnational Access Programme. The expedition is part of the larger international AMASE project, which uses extreme environments on Earth as a test-bed for technology that will be used on future NASA and ESA 'Search for Life' missions to Mars.

"Glacial snow and ice is a good analogue for ice and frost-covered ground at the Martian poles or other icy bodies in the Solar System, like Europa," said Professor Benning.

"Organisms that live here have evolved to thrive with very little food, large temperature fluctuations, dehydration and high levels of UV radiation. For example, snow algae make carotinoids pigments that protect them from UV radiation and cause the snow to turn bright red.

"If we can learn more about how life can form and thrive in these areas, and the survival strategies they adopt, it gives us a better chance of detecting life on other planets with similarly extreme conditions."

To date, studies of microorganisms in the cryo-world have focused on life found in sediment-rich subglacial ice or in melt holes on the surface. Signs of life present in surface ice and snow have not been studied as extensively.

The team will collect samples from snow fields near the Ny-Ålesund research station and from more remote glacial sites, which they will access by helicopter.

The samples will be filtered, preserved and shipped back to the UK for laboratory analysis. The team will also study microorganisms on site using 'life-detection techniques' that will allow them to determine live/dead cell counts, catalogue the biodiversity, investigate the geochemistry of inorganic samples and analyse the DNA of microorganisms.

"It's a little like CSI in the snow," said Professor Benning. "Just like a forensics team investigating a crime scene, we have to make sure we are not detecting any contaminants we might have brought with us into the field.

"The sensitivity of our techniques is also key. If life does exist on other planets, it is likely to be present in very small amounts -- just a few cells in a large area -- so we need very sensitive equipment that can detect very small signals. If we don't get our experiments right on the ground, they have little chance of working elsewhere in the solar system."

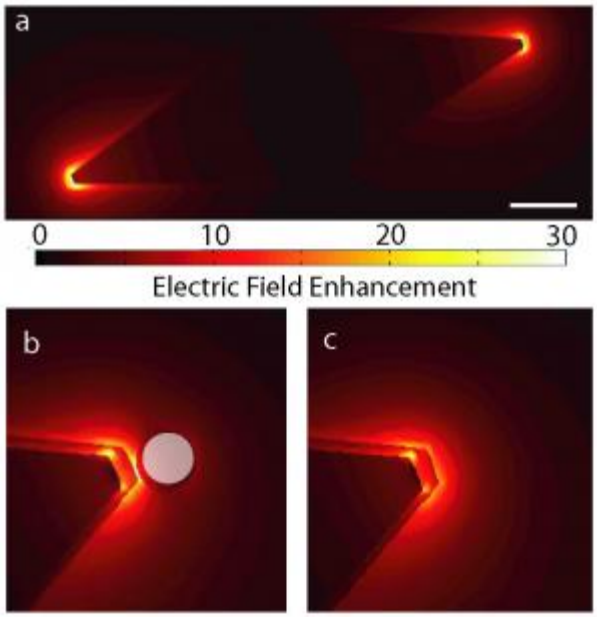
Professor Benning will be blogging about her experiences on the Europlanet Outreach Website: http://www.europlanet-eu.org/outreach/index.php?option=com_content&task=view&id=259&Itemid=2

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Europlanet Media Centre**, via AlphaGalileo.

http://www.sciencedaily.com/releases/2010/08/100806125556.htm

Timely Technology Sees Tiny Transitions



This computer simulation shows the electric field of a bipyramid. Molecules moving through the field shift the quality of light, which can be read via spectroscopy. (Credit: Nordlander lab)

ScienceDaily (Aug. 7, 2010) — Scientists can detect the movements of single molecules by using fluorescent tags or by pulling them in delicate force measurements, but only for a few minutes. A new technique by Rice University researchers will allow them to track single molecules without modifying them -- and it works over longer timescales.

In the current issue of *Nanotechnology*, a team led by Jason Hafner, an associate professor of physics and astronomy and of chemistry, has shown that the plasmonic properties of nanoparticles can "light up" molecular interactions at the single-molecule limit in ways that will be useful to scientists.

Hafner's method takes advantage of the ability of metal nanoparticles to focus light down to biomolecular scales through an effect called localized surface plasmon resonance (LSPR). The gold nanoparticles ultimately used in the experiment scatter light in visible wavelengths, which can be detected and spectrally analyzed in a microscope.

"The exact peak wavelength of the resonance is highly sensitive to small perturbations in the nearby dielectric environment," said graduate student Kathryn Mayer, the lead student on the experiment. "By tracking the peak with a spectrometer, we can detect molecular interactions near the surface of the nanoparticles."

Hafner first discussed their progress at a 2006 conference after a presentation on gold nanostars his lab had developed. "We had extremely preliminary data, and I said, 'Maybe we've got it.' I thought we were close," he recalled.

What took time was finding the right particle. "We started with nanorods, which don't scatter light well, at least not the small nanorods we produce in my lab. Then we tried nanostars and found they were very bright and sensitive, but each was a different shape and had a different peak wavelength."

The team settled on bipyramids, 140-nanometer-long, 10-sided gold particles that focus light at their sharp tips, creating a halo-like "sensing volume," the dielectric environment in which changes can be read by a spectrometer.

Hafner and his colleagues borrowed bioconjugate chemistry techniques, coating the bipyramids with antibodies and then adding antigens that strongly bind to them. Then the antigens were rinsed off. Whenever one was released from its bond to the bipyramid antibody, the researchers detected a slight shift toward the blue in the red light naturally scattered by gold bipyramids.

The process is "label-free," meaning the molecule itself is being detected, rather than a fluorescent tag that requires modification of the molecule, Hafner said. Also, the dielectric property being detected is permanent, so molecules could be tracked for more than 10 hours, as compared with only minutes with current methods."The ability to measure over long time scales opens the possibility to study systems with strong affinity at the single-molecule limit, such as lectin-carbohydrate interactions responsible for cell recognition and adhesion," Hafner said. "Other single-molecule methods based on fluorescence are limited by photo bleaching, and those based on force measurements are limited by radiation damage and mechanical instabilities."

Work needs to be done before LSPR becomes an ideal biological sensor, he said. The team plans to tweak the bipyramids and will test other particles."With this bipyramid, we went a little too red," he said. "It's a compromise. Make them long and they're really sensitive, but so red that we don't get much signal. Make them shorter, they're somewhat less sensitive but you have more signal.

"If we can get the signal-to-noise ratio up by a factor of two or three, we think it will be a powerful method for biological research."In addition to Mayer, Hafner's co-authors included Peter Nordlander, a Rice professor of physics and astronomy and of electrical and computer engineering, former Rice graduate student Feng Hao, now a postdoctoral fellow at Sandia National Laboratories, and Rice graduate student Seunghyun Lee.

Funding for the project came from the National Science Foundation's Integrative Graduate Research and Educational Training program and Nanoscale Science and Engineering Initiative, the U.S. Army Research Office and the Welch Foundation.

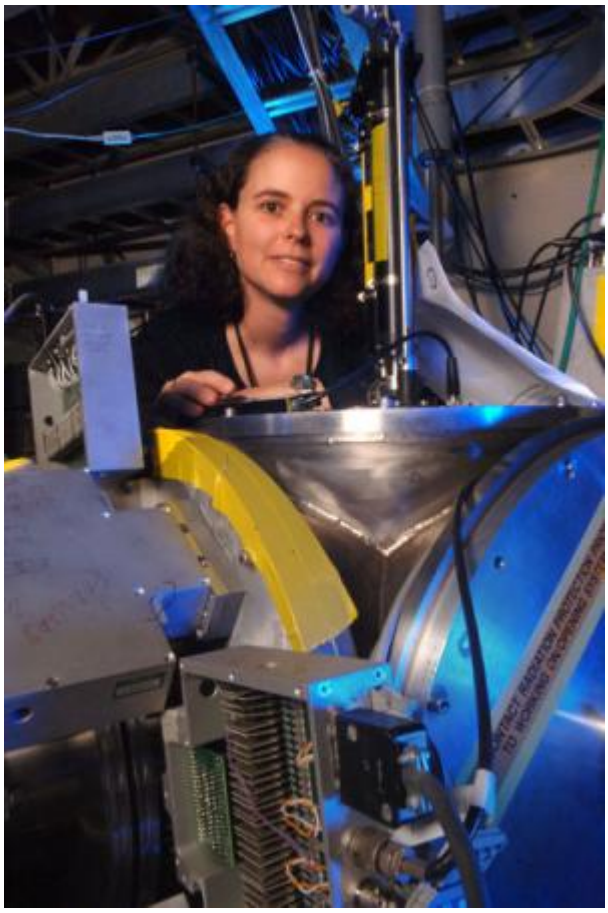
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Rice University**.

Journal Reference:

1. Mayer et al. **A single molecule immunoassay by localized surface plasmon resonance**. *Nanotechnology*, 2010; 21 (25): 255503 DOI: 10.1088/0957-4484/21/25/255503

http://www.sciencedaily.com/releases/2010/06/100623165131.htm

Nuclear Physicists Study 'Magic' Nature of Tin



Kate Jones, former Rutgers postdoctoral researcher, now assistant professor at the University of Tennessee. (Credit: Oak Ridge Associated Universities)

ScienceDaily (Aug. 7, 2010) — The metal tin lacks the value and prestige of gold, silver, and platinum -- but to nuclear physicists, tin is magic.

In the journal *Nature*, Rutgers physicists recently reported studies on tin that add knowledge to a concept known as magic numbers while perhaps helping scientists to explain how heavy elements are made in exploding stars.

Their research methods could also help other scientists and engineers develop next-generation nuclear reactors and gather forensic evidence in case rogue states or terrorists ever deploy nuclear weapons.

Physicists who study the nuclei of atoms -- the dense cluster of protons and neutrons at the atom's center -- apply the "magic" moniker to elements with a certain number of protons or combination of protons and neutrons. At these numbers -- 2, 8, 20, 28, 50, 82, and 126 -- the protons and neutrons are tightly bound together, giving many "magic" elements a high degree of stability in their nuclei.

Articulated by Maria Goeppert-Mayer and J. Hans D. Jensen during the 1940s, the concept was part of their nuclear shell model that earned them the Nobel Prize in physics in 1963. The concept is akin to noble gases such as helium and neon, which are stable and don't react with other elements because their numbers of electrons fill orbital shells.

Professor Jolie Cizewski and postdoctoral researcher Kate Jones, now an assistant professor at the University of Tennessee in Knoxville, wanted to boost the scientific community's knowledge of magic numbers by studying an isotope of tin that is, in fact, doubly magic -- with 50 protons and 82 neutrons. Isotopes are different atomic forms of the same element, with the same number of protons but different numbers of neutrons.

Unlike other magic nuclei that are stable, however, this isotope of tin is fleeting. Its half-life, or the time it takes for half the material to radioactively decay, is 40 seconds. That's far too brief to conduct many direct studies of its nuclear properties.

Working at the Oak Ridge National Laboratory's Holifield Radioactive Ion Beam Facility, Jones and Cizewski created this short-lived but magic isotope of tin and immediately modified it by adding a single neutron -- converting it from tin-132 (the isotope with 82 neutrons) to tin-133 (the isotope with 83 neutrons). By examining properties of an ejected particle in the course of producing tin-133, they could deduce properties of the doubly-magic isotope of tin that couldn't be studied directly.

Using funding from a 2003 Department of Energy National Nuclear Security Administration grant, Cizewski and her collaborators developed the technique that Jones applied to this study."The properties we're studying in our experiment have parallels to the formation of elements heavier than iron in stars," Cizewski said. "This form of tin may be formed in supernova explosions or collisions of neutron stars, and lies along the path to forming heavier elements."

The knowledge gained using this neutron transfer process for research could also help investigators if rogue states or terrorists ever fabricate and detonate a nuclear weapon. It could help scientists read a bomb's nuclear fission products like a fingerprint that could lead investigators to the suspected bomb builder.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Rutgers University**.

Journal Reference:

1. K. L. Jones, A. S. Adekola, D. W. Bardayan, J. C. Blackmon, K. Y. Chae, K. A. Chipps, J. A. Cizewski, L. Erikson, C. Harlin, R. Hatarik, R. Kapler, R. L. Kozub, J. F. Liang, R. Livesay, Z. Ma, B. H. Moazen, C. D. Nesaraja, F. M. Nunes, S. D. Pain, N. P. Patterson, D. Shapira, J. F. Shriner, M. S. Smith, T. P. Swan, J. S. Thomas. **The magic nature of ^{132}Sn explored through the single-particle states of ^{133}Sn**. *Nature*, 2010; 465 (7297): 454 DOI: 10.1038/nature09048

http://www.sciencedaily.com/releases/2010/08/100806161855.htm

Spinal-Fluid Test Is Found to Predict Alzheimer's

By GINA KOLATA

Researchers report that a spinal fluid test can be 100 percent accurate in identifying patients with significant memory loss who are on their way to developing Alzheimer's disease.

Although there has been increasing evidence of the value of this and other tests in finding signs of Alzheimer's, the study, which will appear Tuesday in the Archives of Neurology, shows how accurate they can be. The new result is one of a number of remarkable recent findings about Alzheimer's.

After decades when nothing much seemed to be happening, when this progressive brain disease seemed untreatable and when its diagnosis could be confirmed only at autopsy, the field has suddenly woken up.

Alzheimer's, medical experts now agree, starts a decade or more before people have symptoms. And by the time there are symptoms, it may be too late to save the brain. So the hope is to find good ways to identify people who are getting the disease, and use those people as subjects in studies to see how long it takes for symptoms to occur and in studies of drugs that may slow or stop the disease.

Researchers are finding simple and accurate ways to detect Alzheimer's long before there are definite symptoms. In addition to spinal fluid tests they also have new PET scans of the brain that show the telltale amyloid plaques that are a unique feature of the disease. And they are testing hundreds of new drugs that, they hope, might change the course of the relentless brain cell death that robs people of their memories and abilities to think and reason.

"This is what everyone is looking for, the bull's-eye of perfect predictive accuracy," Dr. Steven DeKosky, dean of the University of Virginia medical school, who is not connected to the new research, said about the spinal tap study.

Dr. John Morris, a professor of neurology at Washington University, said the new study "establishes that there is a signature of Alzheimer's and that it means something. It is very powerful."

A lot of work lies ahead, researchers say — making sure the tests are reliable if they are used in doctors' offices, making sure the research findings hold up in real-life situations, getting doctors and patients comfortable with the notion of spinal taps, the method used to get spinal fluid. But they see a bright future.

Although the latest PET scans for Alzheimer's are not commercially available, the spinal fluid tests are.

So the new results also give rise to a difficult question: Should doctors offer, or patients accept, commercially available spinal tap tests to find a disease that is yet untreatable? In the research studies, patients are often not told they may have the disease, but in practice in the real world, many may be told.

Some medical experts say it should be up to doctors and their patients. Others say doctors should refrain from using the spinal fluid test in their practices. They note that it is not reliable enough — results can vary by lab — and has been studied only in research settings where patients are carefully selected to have no other conditions, like strokes or depression, that could affect their memories.

"This is literally on the cutting edge of where the field is," Dr. DeKosky said. "The field is moving fast. You can get a test that is approved by the F.D.A., and cutting edge doctors will use it."

But, said Dr. John Trojanowski, a University of Pennsylvania researcher and senior author of the paper, given that people can get the test now, "How early do you want to label people?"

Some, like Dr. John Growdon, a neurology professor at Massachusetts General Hospital who wrote an editorial accompanying the paper, said that decision was up to doctors and their patients.

Sometimes patients with severe memory loss do not have the disease. Doctors might want to use the test in cases where they want to be sure of the diagnosis. And they might want to offer the test to people with milder symptoms who want to know whether they are developing the devastating brain disease.

One drawback, though, is that spinal fluid is obtained with a spinal tap, and that procedure, with its reputation for pain and headaches, makes most doctors and many patients nervous. The procedure involves putting a needle in the spinal space and withdrawing a small amount of fluid.

Dr. Growdon and others say spinal taps are safe and not particularly painful for most people. But, he said, there needs to be an education campaign to make people feel more comfortable about having them. He suggested that, because most family doctors and internists are not experienced with the test, there could be special spinal tap centers where they could send patients.

The new study included more than 300 patients in their 70s, 114 with normal memories, 200 with memory problems and 102 with Alzheimer's disease. Their spinal fluid was analyzed for amyloid beta, a protein fragment that forms plaques in the brain, and for tau, a protein that accumulates in dead and dying nerve cells in the brain. To avoid bias, the researchers analyzing the data did not know anything about the clinical status of the subjects. Also, the subjects were not told what the tests showed.

Nearly every person with Alzheimer's had the characteristic spinal fluid protein levels. Nearly three quarters of people with mild cognitive impairment, a memory impediment that can precede Alzheimer's, had Alzheimer's-like spinal fluid proteins. And every one of those patients with the proteins developed Alzheimer's within five years. And about a third of people with normal memories had spinal fluid indicating Alzheimer's. Researchers suspect that those people will develop memory problems.

The prevailing hypothesis about Alzheimer's says that amyloid and tau accumulation are necessary for the disease and that stopping the proteins could stop the disease. But it is not yet known what happens when these proteins accumulate in the brains of people with normal memories. They might be a risk factor like high cholesterol levels. Many people with high cholesterol levels never have heart attacks. Or it might mean that Alzheimer's has already started and if the person lives long enough he or she will with absolute certainty get symptoms like memory loss.

Many, like Dr. DeKosky, believe that when PET scans for amyloid become available, they will be used instead of spinal taps, in part because doctors and patients are more comfortable with brain scans.

And when — researchers optimistically are saying "when" these days — drugs are shown to slow or prevent the disease, the thought is that people will start having brain scans or spinal taps for Alzheimer's as routinely as they might have colonoscopies or mammograms today.

For now, Dr. DeKosky said, the days when Alzheimer's could be confirmed only at autopsy are almost over. And the time when Alzheimer's could be detected only after most of the brain damage was done seem to be ending, too.

"The new biomarkers in CSF have made the difference," Dr. DeKosky said, referring to cerebral spinal fluid. "This confirms their accuracy in a very big way."

http://www.nytimes.com/2010/08/10/health/research/10spinal.html?nl=health&emc=healthupdateema2

When the Doctor Doesn't Look Like You

By PAULINE W. CHEN, M.D.

One night during my training, over dinner in the hospital cafeteria, a fellow resident and I had a discussion about the situation of one of our professors. Known for his blistering teaching sessions, this senior surgeon possessed the uncanny ability to sniff out lapses in memory or judgment among doctors-in-training. Early on in my internship, I showed up at one of his practice trauma resuscitations blissfully unprepared. I left an hour later with his booming and rapid-fire admonitions still ringing in my ears. "You call yourself a doctor?" he had thundered. "This patient may just be a dummy, but *you* are killing her!"

Nonetheless, this surgeon soon became a favorite of ours. He was brilliant in the operating room, gentle at the patients' bedside and, as I quickly learned, highly effective in the classroom. What continued to vex me, however, was not the peculiarity of his teaching style; it was his inability to attract patients. While other, less-skilled senior doctors had waiting rooms that were overflowing, his was not.

"If I were sick," I said to my fellow resident that night, "I know which surgeon I would ask for."

"But you can understand why some patients and referring doctors don't go to him," she replied matter-of-factly. "Other guys wear Brooks Brothers, have recognizable last names and carry a degree from the 'right' medical school. But when a potential patient or referring doctor sees our guy, all they might notice is a foreigner with an accent and a strange name who graduated from a medical school in some developing country."

Our professor had been born abroad and immigrated to the United States after medical school. But despite clinical accomplishments and professional accolades in this country, I knew, like my fellow resident, that there were patients and physicians whose initial impulse was to dismiss him or any other doctor with an accent or an international degree.

For more than 50 years, international medical school graduates like my former professor have filled the gaps in the physician work force in the United States. Currently, they make up fully one-quarter of all practicing physicians, and although a majority are foreign-born, approximately 20 percent are American citizens who have chosen to go abroad, most notably to the Caribbean, for medical school.

Regardless of whether they are United States citizens, all international graduates must go through an arduous regulatory process before practicing in this country, a process that includes verification of medical school diplomas and transcripts, residency training in American hospitals and the same national three-part licensing exams and specialty tests that their medical school counterparts in this country take. Many go on to choose specialties or work in the rural and disadvantaged geographic locations that their American counterparts shun. International graduates, for example, now account for nearly 30 percent of all primary care doctors, a specialty that has had increasing difficulties attracting American medical students.

Though these doctors have filled an important national health care need for over half a century, doubts regarding the quality of care they provide have continued to plague them. Health care experts interested in this issue have been stymied over the years by inadequate methodologies for evaluating the effectiveness of large groups of physicians and so have chosen instead to focus on exam scores, an admittedly crude proxy for quality of care.

But even that data has proven confusing. Studies initially revealed that international graduates tended to score lower, while more recent research shows that they routinely outperform their peers on training exams in areas like internal medicine.

Now researchers from the Foundation for Advancement of International Medical Education and Research in Philadelphia have published the first study incorporating new research methods for evaluating the performance of large groups of physicians. And it turns out that contrary to certain individuals' worst fears, accent or nationality did not affect patient outcomes. Rather, the main factor was being board-certified: completing a full residency at an accredited training program, passing written and, depending on the specialty, oral examinations, and having proof of experience with a defined set of clinical problems and technical procedures.

The researchers examined the records of more than 240,000 patients who were hospitalized for either congestive heart failure or heart attack and examined how their outcomes correlated with their doctors' education and background. They found no differences in mortality rates between those patients cared for by graduates of international or American medical schools. But on closer review, they found that two factors did contribute significantly to differences in patient outcomes.

Dividing the international medical graduates into those who were foreign-born and those who were American citizens who chose to study abroad, the researchers discovered that patients of foreign-born primary care physicians fared significantly better than patients of American primary care doctors who received their medical degrees either here or abroad. John J. Norcini, lead author of the study and president of the foundation, postulates that the differences may stem from the fact that as primary care has become less attractive for graduates of American medical schools, it has also become less competitive. "The foreign international medical graduates are some of the smartest kids from around the world," he said. "When they come over, they tend to fill in where the U.S. medical school graduates don't necessarily go."

Dr. Norcini and his co-investigators also found that patient mortality rates were related to the doctor's board certification and time since medical school graduation, regardless of his or her background. Those physicians

in the study who were board-certified had substantially lower death rates among their patients. And the greater the number of years since medical school graduation, the more likely that doctor was to have a patient with heart attack or congestive heart failure die in the hospital.

“If you put these two pieces of data together,” Dr. Norcini said, “they make a strong argument for board certification and the maintenance of certification programs currently being put in place to improve the periodic reassessment of board-certified doctors.”

While the results of this study will help Dr. Norcini and other medical educators further refine the regulatory process for physicians from international and domestic medical schools, Dr. Norcini points out that there is a “huge heterogeneity in all these groups” and cautions doctors and patients against making broad generalizations about any physician group. Instead, when searching for the best doctors, he recommends focusing not on a doctor’s medical school or country of origin but rather on board certification.

“My hope is that we begin to rely more on objective markers like board certification as a statement of quality rather than where someone went to medical school,” Dr. Norcini said. “One can always ask a doctor if he or she is board-certified and involved in maintaining that certification. It’s a straightforward quality marker, and it’s a question that’s easy to ask.”

He added, “And as a patient, I find that reassuring.”

http://www.nytimes.com/2010/08/12/health/12chen.html?_r=1&ref=health

Antibiotic-Resistant Bacteria Moving From South Asia to U.S.

By DONALD G. McNEIL Jr.

A dangerous new mutation that makes some bacteria resistant to almost all antibiotics has become increasingly common in India and Pakistan and is being found in patients in Britain and the United States who got medical care in those countries, according to new studies.

Experts in antibiotic resistance called the gene mutation, named NDM-1, "worrying" and "ominous," and they said they feared it would spread globally.

But they also put it in perspective: there are numerous strains of antibiotic-resistant germs, and although they have killed many patients in hospitals and nursing homes, none have yet lived up to the "superbug" and "flesh-eating bacteria" hyperbole that greets the discovery of each new one.

"They're all bad," said Dr. Martin J. Blaser, chairman of medicine at New York University Langone Medical Center. "Is NDM-1 more worrisome than MRSA? It's too early to judge."

(MRSA, or methicillin-resistant staphylococcus aureus, is a hard-to-treat bacterium that used to cause problems only in hospitals but is now found in gyms, prisons and nurseries, and is occasionally picked up by healthy people through cuts and scrapes.)

Bacteria with the NDM-1 gene are resistant even to the antibiotics called carbapenems, used as a last resort when common antibiotics have failed. The mutation has been found in E. coli and in Klebsiella pneumoniae, a frequent culprit in respiratory and urinary infections.

"I would not like to be working at a hospital where this was introduced," said Dr. William Schaffner, chairman of preventive medicine at Vanderbilt University. "It could take months before you got rid of it, and treating individual patients with it could be very difficult."

A study tracking the spread of the mutation from India and Pakistan to Britain was published online on Tuesday in the journal Lancet.

In June, the Centers for Disease Control and Prevention noted the first three cases of NDM-1 resistance in this country and advised doctors to watch for it in patients who had received medical care in South Asia. The initials stand for New Delhi metallo-beta-lactamase.

"Medical tourism" to India for many surgeries — cosmetic, dental and even organ transplants — is becoming more common as experienced surgeons and first-class hospitals offer care at a fraction of Western prices. Tourists and people visiting family are also sometimes hospitalized. The Lancet researchers found dozens of samples of bacteria with the NDM-1 resistance gene in two Indian cities they surveyed, which they said "suggests a serious problem."

Also worrying was that the gene was found on plasmids — bits of mobile DNA that can jump easily from one bacteria strain to another. And it is found in gram-negative bacteria, for which not many new antibiotics are being developed. (MRSA, by contrast, is a gram-positive bacteria, and there are more drug candidates in the works.)

Dr. Alexander J. Kallen, an expert in antibiotic resistance at the C.D.C., called it “one of a number of very serious bugs we’re tracking.”

But he noted that a decade ago, New York City hospitals were the epicenter of infections with other bacteria resistant to carbapenem antibiotics. Those bacteria, which had a different mutation, were troubling, but did not explode into a public health emergency.

Drug-resistant bacteria like those with the NDM-1 mutation are usually a bigger threat in hospitals, where many patients are on broad-spectrum antibiotics that wipe out the normal bacteria that can hold antibiotic-resistant ones in check.

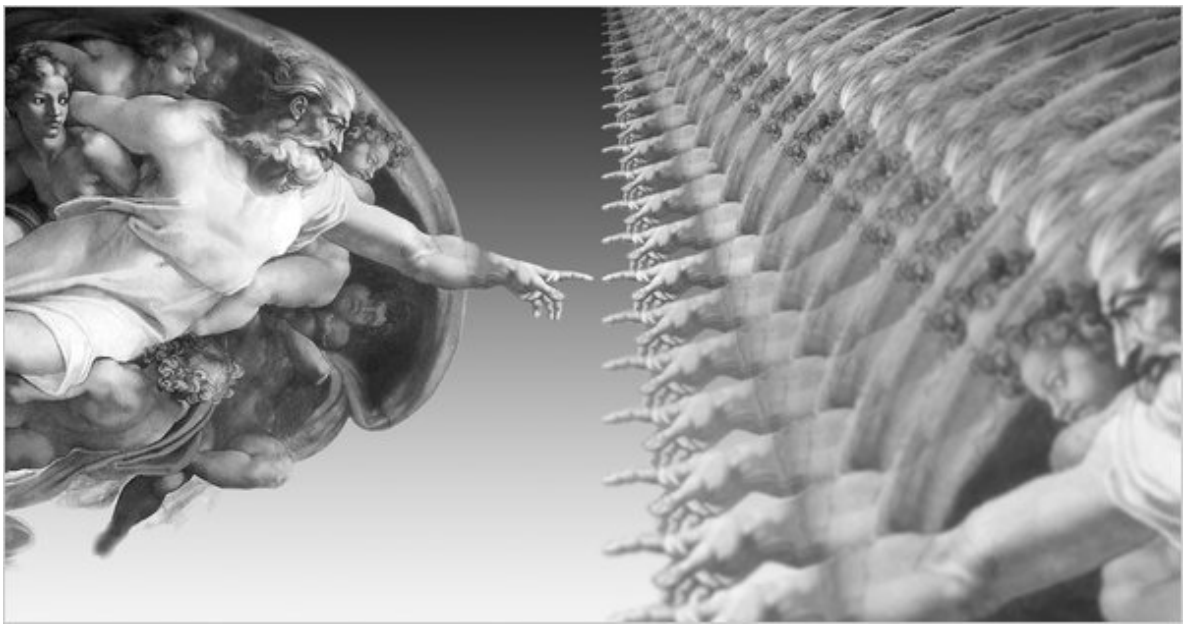
Also, hospital patients generally have weaker immune systems and more wounds to infect, and are examined with more scopes and catheters that can let bacteria in.

http://www.nytimes.com/2010/08/12/world/asia/12bug.html?ref=health

The First Church of Robotics

By JARON LANIER

Berkeley, Calif.



d

THE news of the day often includes an item about some development in artificial intelligence: a machine that smiles, a program that can predict human tastes in mates or music, a robot that teaches foreign languages to children. This constant stream of stories suggests that machines are becoming smart and autonomous, a new form of life, and that we should think of them as fellow creatures instead of as tools. But such conclusions aren't just changing how we think about computers — they are reshaping the basic assumptions of our lives in misguided and ultimately damaging ways.

I myself have worked on projects like machine vision algorithms that can detect human facial expressions in order to animate avatars or recognize individuals. Some would say these too are examples of A.I., but I would say it is research on a specific software problem that shouldn't be confused with the deeper issues of intelligence or the nature of personhood. Equally important, my philosophical position has not prevented me from making progress in my work. (This is not an insignificant distinction: someone who refused to believe in, say, general relativity would not be able to make a GPS navigation system.)

In fact, the nuts and bolts of A.I. research can often be more usefully interpreted without the concept of A.I. at all. For example, I.B.M. scientists recently unveiled a "question answering" machine that is designed to play the TV quiz show "Jeopardy." Suppose I.B.M. had dispensed with the theatrics, declared it had done Google one better and come up with a new phrase-based search engine. This framing of exactly the same technology would have gained I.B.M.'s team as much (deserved) recognition as the claim of an artificial intelligence, but would also have educated the public about how such a technology might actually be used most effectively.

Another example is the way in which robot teachers are portrayed. For starters, these robots aren't all that sophisticated — miniature robotic devices used in endoscopic surgeries are infinitely more advanced, but they don't get the same attention because they aren't presented with the A.I. spin.

Furthermore, these robots are just a form of high-tech puppetry. The children are the ones making the transaction take place — having conversations and interacting with these machines, but essentially teaching themselves. This just shows that humans are social creatures, so if a machine is presented in a social way, people will adapt to it.

What bothers me most about this trend, however, is that by allowing artificial intelligence to reshape our concept of personhood, we are leaving ourselves open to the flipside: we think of people more and more as computers, just as we think of computers as people.

In one recent example, Clay Shirky, a professor at New York University's Interactive Telecommunications Program, has suggested that when people engage in seemingly trivial activities like "re-Tweeting," relaying on Twitter a short message from someone else, something non-trivial — real thought and creativity — takes place on a grand scale, within a global brain. That is, people perform machine-like activity, copying and relaying information; the Internet, as a whole, is claimed to perform the creative thinking, the problem solving, the connection making. This is a devaluation of human thought.

Consider too the act of scanning a book into digital form. The historian George Dyson has written that a Google engineer once said to him: "We are not scanning all those books to be read by people. We are scanning them to be read by an A.I." While we have yet to see how Google's book scanning will play out, a machine-centric vision of the project might encourage software that treats books as grist for the mill, decontextualized snippets in one big database, rather than separate expressions from individual writers. In this approach, the contents of books would be atomized into bits of information to be aggregated, and the authors themselves, the feeling of their voices, their differing perspectives, would be lost.

What all this comes down to is that the very idea of artificial intelligence gives us the cover to avoid accountability by pretending that machines can take on more and more human responsibility. This holds for things that we don't even think of as artificial intelligence, like the recommendations made by Netflix and Pandora. Seeing movies and listening to music suggested to us by algorithms is relatively harmless, I suppose. But I hope that once in a while the users of those services resist the recommendations; our exposure to art shouldn't be hemmed in by an algorithm that we merely want to believe predicts our tastes accurately. These algorithms do not represent emotion or meaning, only statistics and correlations.

What makes this doubly confounding is that while Silicon Valley might sell artificial intelligence to consumers, our industry certainly wouldn't apply the same automated techniques to some of its own work. Choosing design features in a new smartphone, say, is considered too consequential a game. Engineers don't seem quite ready to believe in their smart algorithms enough to put them up against Apple's chief executive, Steve Jobs, or some other person with a real design sensibility.

But the rest of us, lulled by the concept of ever-more intelligent A.I.'s, are expected to trust algorithms to assess our aesthetic choices, the progress of a student, the credit risk of a homeowner or an institution. In doing so, we only end up misreading the capability of our machines and distorting our own capabilities as human beings. We must instead take responsibility for every task undertaken by a machine and double check every conclusion offered by an algorithm, just as we always look both ways when crossing an intersection, even though the light has turned green.

WHEN we think of computers as inert, passive tools instead of people, we are rewarded with a clearer, less ideological view of what is going on — with the machines and with ourselves. So, why, aside from the theatrical appeal to consumers and reporters, must engineering results so often be presented in Frankensteinian light?

The answer is simply that computer scientists are human, and are as terrified by the human condition as anyone else. We, the technical elite, seek some way of thinking that gives us an answer to death, for instance. This helps explain the allure of a place like the Singularity University. The influential Silicon Valley institution preaches a story that goes like this: one day in the not-so-distant future, the Internet will suddenly coalesce into a super-intelligent A.I., infinitely smarter than any of us individually and all of us combined; it will become alive in the blink of an eye, and take over the world before humans even realize what's happening.

Some think the newly sentient Internet would then choose to kill us; others think it would be generous and digitize us the way Google is digitizing old books, so that we can live forever as algorithms inside the global brain. Yes, this sounds like many different science fiction movies. Yes, it sounds nutty when stated so bluntly. But these are ideas with tremendous currency in Silicon Valley; these are guiding principles, not just amusements, for many of the most influential technologists.

It should go without saying that we can't count on the appearance of a soul-detecting sensor that will verify that a person's consciousness has been virtualized and immortalized. There is certainly no such sensor with us today to confirm metaphysical ideas about people, or even to recognize the contents of the human brain. All thoughts about consciousness, souls and the like are bound up equally in faith, which suggests something remarkable: What we are seeing is a new religion, expressed through an engineering culture.

What I would like to point out, though, is that a great deal of the confusion and rancor in the world today concerns tension at the boundary between religion and modernity — whether it's the distrust among Islamic or Christian fundamentalists of the scientific worldview, or even the discomfort that often greets progress in fields like climate change science or stem-cell research. If technologists are creating their own ultramodern religion, and it is one in which people are told to wait politely as their very souls are made obsolete, we might expect further and worsening tensions. But if technology were presented without metaphysical baggage, is it possible that modernity would not make people as uncomfortable?

Technology is essentially a form of service. We work to make the world better. Our inventions can ease burdens, reduce poverty and suffering, and sometimes even bring new forms of beauty into the world. We can give people more options to act morally, because people with medicine, housing and agriculture can more easily afford to be kind than those who are sick, cold and starving.

But civility, human improvement, these are still choices. That's why scientists and engineers should present technology in ways that don't confound those choices.

We serve people best when we keep our religious ideas out of our work. Jaron Lanier, a partner architect at Microsoft Research and an innovator in residence at the Annenberg School of the University of Southern California, is the author, most recently, of "You Are Not a Gadget."

http://www.nytimes.com/2010/08/09/opinion/09lanier.html

Portugal Gives Itself a Clean-Energy Makeover

By ELISABETH ROSENTHAL

LISBON — Five years ago, the leaders of this sun-scorched, wind-swept nation made a bet: To reduce Portugal's dependence on imported fossil fuels, they embarked on an array of ambitious renewable energy projects — primarily harnessing the country's wind and hydropower, but also its sunlight and ocean waves.

Today, Lisbon's trendy bars, Porto's factories and the Algarve's glamorous resorts are powered substantially by clean energy. Nearly 45 percent of the electricity in Portugal's grid will come from renewable sources this year, up from 17 percent just five years ago.

Land-based wind power — this year deemed "potentially competitive" with fossil fuels by the International Energy Agency in Paris — has expanded sevenfold in that time. And Portugal expects in 2011 to become the first country to inaugurate a national network of charging stations for electric cars.

"I've seen all the smiles — you know: It's a good dream. It can't compete. It's too expensive," said Prime Minister José Sócrates, recalling the way Silvio Berlusconi, the Italian prime minister, mockingly offered to build him an electric Ferrari. Mr. Sócrates added, "The experience of Portugal shows that it is possible to make these changes in a very short time."

The oil spill in the Gulf of Mexico has renewed questions about the risks and unpredictable costs of America's unremitting dependence on fossil fuels. President Obama has seized on the opportunity to promote his goal of having 20 to 25 percent of America's electricity produced from renewable sources by 2025.

While Portugal's experience shows that rapid progress is achievable, it also highlights the price of such a transition. Portuguese households have long paid about twice what Americans pay for electricity, and prices

have risen 15 percent in the last five years, probably partly because of the renewable energy program, the International Energy Agency says.

Although a 2009 report by the agency called Portugal's renewable energy transition a "remarkable success," it added, "It is not fully clear that their costs, both financial and economic, as well as their impact on final consumer energy prices, are well understood and appreciated."

Indeed, complaints about rising electricity rates are a mainstay of pensioners' gossip here. Mr. Sócrates, who after a landslide victory in 2005 pushed through the major elements of the energy makeover over the objections of the country's fossil fuel industry, survived last year's election only as the leader of a weak coalition.

"You cannot imagine the pressure we suffered that first year," said Manuel Pinho, Portugal's minister of economy and innovation from 2005 until last year, who largely masterminded the transition, adding, "Politicians must take tough decisions."

Still, aggressive national policies to accelerate renewable energy use are succeeding in Portugal and some other countries, according to a recent report by IHS Emerging Energy Research of Cambridge, Mass., a leading energy consulting firm. By 2025, the report projected, Ireland, Denmark and Britain will also get 40 percent or more of their electricity from renewable sources; if power from large-scale hydroelectric dams, an older type of renewable energy, is included, countries like Canada and Brazil join the list.

The United States, which last year generated less than 5 percent of its power from newer forms of renewable energy, will lag behind at 16 percent (or just over 20 percent, including hydroelectric power), according to IHS.

To force Portugal's energy transition, Mr. Sócrates's government restructured and privatized former state energy utilities to create a grid better suited to renewable power sources. To lure private companies into Portugal's new market, the government gave them contracts locking in a stable price for 15 years — a subsidy that varied by technology and was initially high but decreased with each new contract round.

Compared with the United States, European countries have powerful incentives to pursue renewable energy. Many, like Portugal, have little fossil fuel of their own, and the European Union's emissions trading system discourages fossil fuel use by requiring industry to essentially pay for excessive carbon dioxide emissions.

Portugal was well poised to be a guinea pig because it has large untapped resources of wind and river power, the two most cost-effective renewable sources. Government officials say the energy transformation required no increase in taxes or public debt, precisely because the new sources of electricity, which require no fuel and produce no emissions, replaced electricity previously produced by buying and burning imported natural gas, coal and oil. By 2014 the renewable energy program will allow Portugal to fully close at least two conventional power plants and reduce the operation of others.

"So far the program has placed no stress on the national budget" and has not created government debt, said Shinji Fujino, head of the International Energy Agency's country study division.

If the United States is to catch up to countries like Portugal, energy experts say, it must overcome obstacles like a fragmented, outdated energy grid poorly suited to renewable energy; a historic reliance on plentiful and

cheap supplies of fossil fuels, especially coal; powerful oil and coal industries that often oppose incentives for renewable development; and energy policy that is heavily influenced by individual states.

The relative costs of an energy transition would inevitably be higher in the United States than in Portugal. But as the expense of renewable power drops, an increasing number of countries see such a shift as worthwhile, said Alex Klein, research director, clean and renewable power generation, at IHS.

"The cost gap will close in the next decade, but what you get right away is an energy supply that is domestically controlled and safer," Mr. Klein said.

Necessity Drives Change

Portugal's venture was driven by necessity. With a rising standard of living and no fossil fuel of its own, the cost of energy imports — principally oil and gas — doubled in the last decade, accounting for 50 percent of the country's trade deficit, and was highly volatile. The oil went to fuel cars, the gas mainly to electricity. Unlike the United States, Portugal never depended heavily on coal for electricity generation because close and reliable sources of natural gas were available in North Africa, and Europe's carbon trading system could make coal costly.

Portugal is now on track to reach its goal of using domestically produced renewable energy, including large-scale hydropower, for 60 percent of its electricity and 31 percent of its total energy needs by 2020. (Total energy needs include purposes other than generating electricity, like heating homes and powering cars.)

In making the shift, Portugal has overcome longstanding concerns about reliability and high cost. The lights go on in Lisbon even when the wind dies down at the vast two-year-old Alto Minho wind farm. The country's electricity production costs and consumer electricity rates — including the premium prices paid for power from renewable sources — are about average for Europe, but still higher than those in China or the United States, countries that rely on cheap coal.

Portugal says it has kept costs down by focusing heavily on the cheapest forms of renewable energy — wind and hydropower — and ratcheting down the premium prices it pays to lure companies to build new plants.

While the government estimates that the total investment in revamping Portugal's energy structure will be about 16.3 billion euros, or $22 billion, that cost is borne by the private companies that operate the grid and the renewable plants and is reflected in consumers' electricity rates. The companies' payback comes from the 15 years of guaranteed wholesale electricity rates promised by the government. Once the new infrastructure is completed, Mr. Pinho said, the system will cost about 1.7 billion euros ($2.3 billion) a year less to run than it formerly did, primarily by avoiding natural gas imports.

A smaller savings will come from carbon credits Portugal can sell under the European Union's carbon trading system: countries and industries that produce fewer emissions than allotted can sell permits to those that exceed their limits.

Mr. Fujino of the International Energy Agency said Portugal's calculations might be optimistic. But he noted that the country's transition had also created a valuable new industry: Last year, for the first time, it became a net power exporter, sending a small amount of electricity to Spain. Tens of thousands of Portuguese work in

the field. Energias de Portugal, the country's largest energy company, owns wind farms in Iowa and Texas, through its American subsidiary, Horizon Wind Energy.

Redesigning the System

A nationwide supply of renewable power requires a grid that can move electricity from windy, sunny places to the cities.

But a decade ago in Portugal, as in many places in the United States today, power companies owned not only power generating plants, but also transmission lines. Those companies have little incentive to welcome new sources of renewable energy, which compete with their investment in fossil fuels. So in 2000, Portugal's first step was to separate making electricity from transporting it, through a mandatory purchase by the government of all transmission lines for electricity and gas at what were deemed fair market prices.

Those lines were then used to create the skeleton of what since 2007 has been a regulated and publicly traded company that operates the national electricity and natural gas networks.

Next, the government auctioned off contracts to private companies to build and operate wind and hydropower plants. Bidders were granted rights based on the government-guaranteed price they would accept for the energy they produced, as well as on their willingness to invest in Portugal's renewable economy, including jobs and other venture capital funds. Some of the winners were foreign companies. In the latest round of bidding, the price guaranteed for wind energy was in the range of the price paid for electricity generated by natural gas.

Such a drastic reorganization might be extremely difficult in the United States, where power companies have strong political sway and states decide whether to promote renewable energy. Colorado recently legislated that 30 percent of its energy must come from renewable sources by 2020, but neighboring Utah has only weak voluntary goals. Coal states, like Kentucky and West Virginia, have relatively few policies to encourage alternative energies.

In Portugal, said Mr. Pinho, the former economy minister, who will join Columbia University's faculty, "the prime minister had an absolute majority."

"He was very strong, and everyone knew we would not step back," Mr. Pinho said.

A Flexible Network

Running a country using electricity derived from nature's highly unpredictable forces requires new technology and the juggling skills of a plate spinner. A wind farm that produces 200 megawatts one hour may produce only 5 megawatts a few hours later; the sun shines intermittently in many places; hydropower is plentiful in the rainy winter, but may be limited in summer.

Portugal's national energy transmission company, Redes Energéticas Nacionais or R.E.N., uses sophisticated modeling to predict weather, especially wind patterns, and computer programs to calculate energy from the various renewable-energy plants. Since the country's energy transition, the network has doubled the number of dispatchers who route energy to where it is needed.

"You need a lot of new skills. It's a real-time operation, and there are far more decisions to be made — every hour, every second," said Victor Baptista, director general of R.E.N. "The objective is to keep the system alive and avoid blackouts."

Like some American states, Portugal has for decades generated electricity from hydropower plants on its raging rivers. But new programs combine wind and water: Wind-driven turbines pump water uphill at night, the most blustery period; then the water flows downhill by day, generating electricity, when consumer demand is highest.

Denmark, another country that relies heavily on wind power, frequently imports electricity from its energy-rich neighbor Norway when the wind dies down; by comparison, Portugal's grid is relatively isolated, although R.E.N. has greatly increased its connection with Spain to allow for energy sharing.

Portugal's distribution system is also now a two-way street. Instead of just delivering electricity, it draws electricity from even the smallest generators, like rooftop solar panels. The government aggressively encourages such contributions by setting a premium price for those who buy rooftop-generated solar electricity. "To make this kind of system work, you have to make a lot of different kinds of deals at the same time," said Carlos Zorrinho, the secretary of state for energy and innovation.

To ensure a stable power base when the forces of nature shut down, the system needs to maintain a base of fossil fuel that can be fired up at will. Although Portugal's traditional power plants now operate many fewer hours than before, the country is also building some highly efficient natural gas plants.

To accommodate all this, Portugal needed new transmission lines from remote windy regions to urban centers. Portugal began modernizing its grid a decade ago. Accommodating a greater share of renewable power cost an additional 480 million euros, or about $637 million, an expense folded into electricity rates, according to R.E.N.

Last year, President Obama offered billions of dollars in grants to modernize the grid in the United States, but it is not clear that such a piecemeal effort will be adequate for renewable power. Widely diverse permitting procedures in different states and the fact that many private companies control local fragments of the grid make it hard to move power over long distances, for example, from windy Iowa to users in Atlanta. The American Society of Civil Engineers gave the United States' grid a "D+," commenting that it is "in urgent need of modernization."

"A real smart national grid would radically change our technology profile," said John Juech, vice president for policy analysis at Garten Rothkopf, a Washington consulting firm that focuses on energy. "But it will be very costly, and the political will may not be there."

A 2009 report commissioned by the Pew Center on Global Climate Change estimated that the United States would have to spend $3 billion to $4 billion a year for the next two decades to create a grid that could accommodate deriving 20 percent of electricity from wind power by 2030 — a 40 percent to 50 percent increase over current spending.

The Drawbacks

Energy experts consider Portugal's experiment a success. But there have been losers. Many environmentalists object to the government plans to double the amount of wind energy, saying lights and noise from turbines will interfere with birds' behavior. Conservation groups worry that new dams will destroy Portugal's cork-oak habitats.

Local companies complain that the government allowed large multinationals to displace them.

Until it became the site of the largest wind farm south of Lisbon, Barão de São João was a sleepy village on the blustery Alentejo Coast, home to farmers who tilled its roller coaster hills and holiday homeowners drawn to cheap land and idyllic views. Renewable energy has brought conflict.

"I know it's good for the country because it's clean energy and it's good for the landowners who got money, but it hasn't brought me any good," said José Cristino, 48, a burly farmer harvesting grain with a wind turbine's thrap-thrap-thrap in the background. "I look at these things day and night." He said 90 percent of the town's population had been opposed.

In Portugal, as in the United States, politicians have sold green energy programs to communities with promises of job creation. Locally, the effect has often proved limited. For example, more than five years ago, the isolated city of Moura became the site of Portugal's largest solar plant because it "gets the most sun of anywhere in Europe and has lots of useless space," said José Maria Prazeres Pós-de-Mina, the mayor.

But while 400 people built the Moura plant, only 20 to 25 work there now, since gathering sunlight requires little human labor. Unemployment remains at 15 percent, the mayor said — though researchers, engineers and foreign delegations frequently visit the town's new solar research center.

Indeed, Portugal's engineers and companies are now global players. Portugal's EDP Renováveis, first listed on stock exchanges in 2008, is the third largest company in the world in wind-generated electricity output. This year, its Portuguese chief executive, Ana Maria Fernandes, signed contracts to sell electricity from its wind farm in Iowa to the Tennessee Valley Authority.

"Broadly, Europe has had great success in this area," said Mr. Juech, the analyst at Garten Rothkopf. "But that is the result of huge government support and intervention, and that raises questions about what happens when you have an economic crisis or political change; will these technologies still be sustainable?"

http://www.nytimes.com/2010/08/10/science/earth/10portugal.html?ref=science

Horned turtles butchered to extinction

- 20:00 16 August 2010 by **Wendy Zukerman**

The giant horned turtles of the Pacific became extinct later than we thought – and we were to blame.

The half-tonne meiolaniid turtles were thought to have died out 30 to 40,000 years ago. With no signs of human interference, climate change was blamed.

Now butchered turtle remains have been found in the South Pacific island nation of Vanuatu. Carbon dating shows that the most recent bones are between 2890 and 2760 years old. Humans arrived 3000 years ago: "Within 200 years, the turtles were gone," says Trevor Worthy of the University of New South Wales in Sydney, Australia, who identified the bones.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1005780107

http://www.newscientist.com/article/dn19320-horned-turtles-butchered-to-extinction.html

Deep blue oceans spawn fewer tropical storms

- 15:58 16 August 2010 by **Anil Ananthaswamy**

Blame the plankton (Image: Jeff Schmaltz, MOD IS Rapid Response Team, GSFC, NASA)

Plankton have a lot to answer for. By colouring ocean waters, the microscopic plants encourage hurricanes and typhoons.

The finding suggests that ocean colour, seen from space, could one day be used to predict changes in the number and intensity of hurricanes and typhoons.Climate change is predicted to decrease the amount of phytoplankton in the ocean, which the study suggests would mean many fewer hurricanes and typhoons hitting American and Asian coastlines.

Clear ocean waters look deep blue, but they become a murkier shade of blue depending on how much phytoplankton – tiny floating plants that are at the base of the ocean food web – they contain.

To quantify the effect this colouring has on tropical cyclones, Anand Gnanadesikan of the Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey, and colleagues modelled the north Pacific subtropical gyre, a massive region of circulating ocean currents over which cyclones form. They found that clearer ocean waters would mean fewer cyclones.

Clear blue gyres

The centres of gyres tend to be clearer than their edges, allowing solar heat to penetrate to nearly 100 metres, while it gets no further than 5 to 10 metres at the edges. This means that areas of ocean that are murky with phytoplankton get warmer nearer the surface, while clearer waters warm up further down.

That deeper heat is carried away from the gyre by its associated deep currents, creating a region that is cooler than the rest of the tropics. There are no such currents to carry away the warmer waters of the murky regions. A cooler area changes patterns of regional air convection and so reduces the number of cyclones over the gyre.

Gnanadesikan and colleagues modelled two cases: one in which the gyre had half its normal chlorophyll levels, and another in which it was completely clear. They found that a clear gyre would reduce the number of tropical cyclone days over the north Pacific by about 70 per cent, whereas reducing the chlorophyll by half led to a 35 per cent drop.

The findings are backed up by records from the 1960s, which show that cyclone activity in the Pacific subtropical gyres during the 1960s was about 20 per cent lower than today, while chlorophyll levels were about half of present-day levels – a trend consistent with the model.

The modelling also showed that the reduction was more pronounced for cyclones whose winds had top speeds greater than 33 metres per second, suggesting that ocean colour can influence the intensity of cyclones as well as their number.

Where's it headed?

Past observations and models predict that warmer oceans will produce less phytoplankton but local effects complicate matters, making it difficult for now to predict how the colour of the gyres may change in coming decades. For instance, increased industrial activity in China has deposited more iron-rich dust in the Pacific over the past 40 years, but it's not known whether this results in more nutrients (and hence more colour) at the edges of the gyre or at the centre.

"The potential for change is significant, but our understanding of the underlying dynamics is so rudimentary that it's not clear that we know which direction the change would be," says Gnanadesikan.

There's also the issue of Atlantic hurricanes, which will require more complicated analysis, says Gnanadesikan. The formation of these hurricanes is affected by sea-surface temperatures in the Pacific, and preliminary analysis shows that if the Pacific gyres were completely clear, Atlantic hurricane activity would fall by 12 per cent, he says.

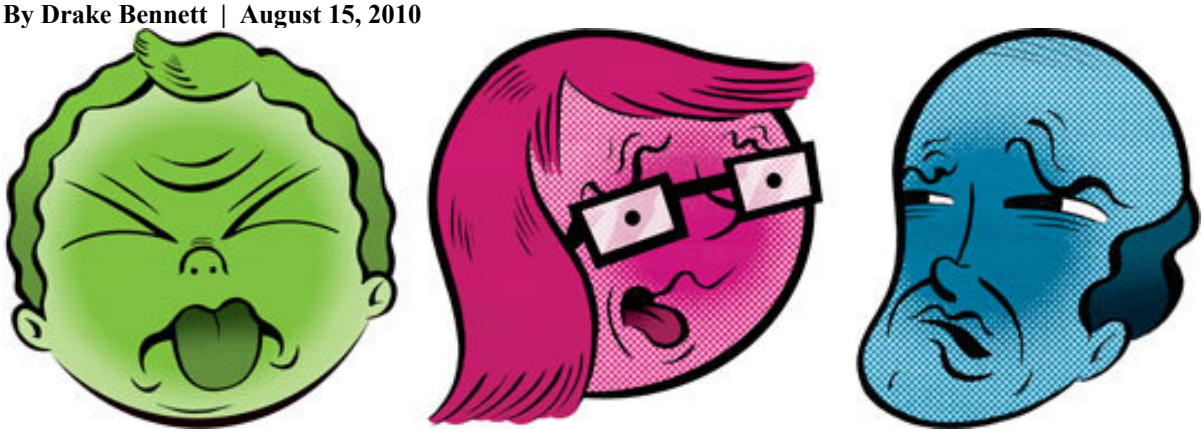
Climate modeller Jimy Dudhia of the National Center for Atmospheric Research in Boulder, Colorado, says that using ocean colour to predict future hurricane activity "is reasonable, given that [the technique] has been validated against past seasons". And Jorge Sarmiento, who studies ocean biogeochemistry and circulation at Princeton University, says that the work "deserves serious consideration".

Journal reference: *Geophysical Research Letters*, DOI: 10.1029/2010gl044514

http://www.newscientist.com/article/dn19319-deep-blue-oceans-spawn-fewer-tropical-storms.html

Ewwwwwwwww!

The surprising moral force of disgust
By Drake Bennett | August 15, 2010



"Two things fill my mind with ever renewed wonder and awe the more often and deeper I dwell on them," wrote Immanuel Kant, "the starry skies above me, and the moral law within me."

Where does moral law come from? What lies behind our sense of right and wrong? For millennia, there have been two available answers. To the devoutly religious, morality is the word of God, handed down to holy men in groves or on mountaintops. To moral philosophers like Kant, it is a set of rules to be worked out by reason, chin on fist like Rodin's thinker.

But what if neither is correct? What if our moral judgments are driven instead by more visceral human considerations? And what if one of those is not divine commandment or inductive reasoning, but simply whether a situation, in some small way, makes us feel like throwing up?

This is the argument that some behavioral scientists have begun to make: That a significant slice of morality can be explained by our innate feelings of disgust. A growing number of provocative and clever studies appear to show that disgust has the power to shape our moral

judgments. Research has shown that people who are more easily disgusted by bugs are more likely to see gay marriage and abortion as wrong. Putting people in a foul-smelling room makes them stricter judges of a controversial film or of a person who doesn't return a lost wallet. Washing their hands makes people feel less guilty about their own moral transgressions, and hypnotically priming them to feel disgust reliably induces them to see wrongdoing in utterly innocuous stories.

Today, psychologists and philosophers are piecing these findings together into a theory of disgust's moral role and the evolutionary forces that determined it: Just as our teeth and tongue first evolved to process food, then were enlisted for complex communication, disgust first arose as an emotional response to ensure that our ancestors steered clear of rancid meat and contagion. But over time, that response was co-opted by the social brain to help police the boundaries of acceptable behavior. Today, some psychologists argue, we recoil at the wrong just as we do at the rancid, and when someone says that a politician's chronic dishonesty makes her sick, she is feeling the same revulsion she might get from a brimming plate of cockroaches.

"Disgust was probably the most underappreciated moral emotion, the most unstudied one," says Jonathan Haidt, a psychologist at the University of Virginia. "It's become politically much more relevant since the culture wars of the 1990s, and so within the broader renaissance of moral psychology disgust has been a particularly hot topic."

Psychologists like Haidt are leading a wave of research into the so-called moral emotions — not just disgust, but others like anger and compassion — and the role those feelings play in how we form moral codes and apply them in our daily lives. A few, like Haidt, go so far as to claim that all the world's moral systems can best be characterized not by what their adherents believe, but what emotions they rely on.

There is deep skepticism in parts of the psychology world about claims like these. And even within the movement there is a lively debate over how much power moral reasoning has — whether our behavior is driven by thinking and reasoning, or whether thinking and reasoning are nothing more than ornate rationalizations of what our emotions ineluctably drive us to do. Some argue that morality is simply how human beings and societies explain the peculiar tendencies and biases that evolved to help our ancestors survive in a world very different from ours.

A few of the leading researchers in the new field met late last month at a small conference in western Connecticut, hosted by the Edge Foundation, to present their work and discuss the implications. Among the points they debated was whether their work should be seen as merely descriptive, or whether it should also be a tool for evaluating religions and moral systems and deciding which were more and less legitimate — an idea that would be deeply offensive to religious believers around the world.

But even doing the research in the first place is a radical step. The agnosticism central to scientific inquiry is part of what feels so dangerous to philosophers and theologians. By telling a story in which morality grows out of the vagaries of human evolution, the new moral psychologists threaten the claim of universality on which most moral systems depend — the idea that certain things are simply right, others simply wrong. If the evolutionary story about the moral emotions is correct, then human beings, by being a less social species or even having a significantly different prehistoric diet, might have ended up today with an entirely different set of religions and ethical codes. Or we might never have evolved the concept of morals at all.

The moral emotions model has another radical implication as well. It means morality is not, as the Buddha and St. Augustine said, a way to curb our animal desires: It's simply an outgrowth of that same animal nature.

Human beings are uniquely squeamish creatures. Even if we eat meat, we're willing to ingest only a minuscule proportion of the world's edible animal species. We're repelled by unfamiliar grooming habits, physical contact with strangers, and even our own bodies — their odor and hair, their adipose tissue and shed skin cells, and every bodily fluid except tears. Not to mention the quease-tinged aversion many people feel toward manipulating genes or cross-dressing or whole categories of sexual activity.

Animals aren't burdened by such feelings. Many species have strong preferences about what they eat, but dislike is not disgust. "You might avoid food for different reasons — you wouldn't eat a rock, you wouldn't eat a food that's unpalatable or boring," says Paul Bloom, a Yale University psychologist who has studied disgust as well as the emergence of moral beliefs in young children. "But disgusting food has a certain property, it gives rise to a distinct facial reaction, distinct worries about what it has come into contact with. You wouldn't eat arsenic and you wouldn't eat a dog turd, but even though eating arsenic is worse for you, the dog turd gives rise to the distinct response."

Researchers describe disgust as a bundle of simultaneous sensations and reactions: We experience revulsion and we physically distance ourselves from the offending object. We feel nauseated and our heart rate lowers. And as Charles Darwin noted, we involuntarily make an expression that seems designed to both ward off odors and expel what we have just eaten — we scrunch our nose, open our mouth, and stick out our tongue.

The origins of disgust remain somewhat mysterious, but it may have first arisen when the diet of our hunter-gatherer forebears began to contain more meat — rotten meat is much more dangerous than rotten vegetables, and even today we're far more disgusted by things that come from animals than things that come from plants. But because disgust worked so well at getting people to steer clear of certain dangerous food — as well as the outward signs of contagious disease in other people (sores, pus, and the like) — Haidt and others hypothesize that as human society grew more complex, disgust also began to serve a social function.

Partly through biological selection, partly as a taught behavior, disgust became a disciplinary mechanism to steer us away from dangerous behaviors. Understanding that betrayal or child rape is wrong is one thing, but actually being sickened by it is a more powerful form of social control.

The facial expression triggered by disgust, the distinctive grimace psychologists call the "gape," also took on a new purpose. Originally a purely protective measure, it became a social cue: a visible signal of disgust at both bodily and behavioral transgressions, and an unmistakable warning to the transgressors themselves.

"The disgust response gets pulled into these higher moral domains having to do with social rules," says Daniel Kelly, a philosopher at Purdue University and author of a forthcoming book on morality and disgust.

And because it is serving a different purpose than the one it evolved for, there are occasional mismatches between the things that elicit disgust and our response, places where the instinct leads people to react in ways that they can't easily explain or defend.

The father of modern disgust research is a psychologist named Paul Rozin. In a series of studies in the 1980s and 1990s that read like hidden-camera pranks, he set out to see how powerful the emotion was, and what exactly it was about disgusting things that repelled us. A professor at the University of Pennsylvania, Rozin served people cups of juice that a sterilized cockroach had been dropped into and offered others chocolate fudge shaped like dog poop. He asked whether subjects would wear a thoroughly laundered sweater that had once belonged to Adolf Hitler. In all those instances, most people refused, even though they knew the cockroach and sweater were clean and that the fudge was in fact fudge. They just felt disgusted.

According to Rozin, the power of our disgust reaction leads us to a sort of magical thinking. "The sense of contamination is what's so interesting," Rozin says. "When the cockroach touches something, we feel like something of the cockroach actually enters it."

More recent work has turned to the role disgust plays in attitudes about right and wrong. For example, Bloom, working with the psychologists David Pizarro and Yoel Inbar at Cornell University, found that people who score higher on a disgust sensitivity scale (sample question: "I try to avoid letting any part of my body touch the toilet seat in a public restroom, even when it appears clean") also tend to be more likely, all else being equal, to believe that gay marriage and abortion are wrong.

Studies by other psychologists suggest an unconscious mental link between immorality and actual dirt and infection. In a much-noted 2006 study, Chen-Bo Zhong and Katie Liljenquist found that thinking of a past

immoral deed made people want to clean their hands with a disinfectant wipe, and that doing so actually made them feel better afterward about their transgression. Zhong and Liljenquist called it the "Macbeth effect," after the guilt-stricken hand washing of Lady Macbeth.

Issues like abortion and gay marriage, of course, intimately implicate the body, so it's less surprising that disgust would play a role. But other researchers have found the emotion at work in more abstract moral judgments.

In a study published early last year in the journal Science, a team led by Hanah Chapman, a psychology PhD student at the University of Toronto, looked at disgust and unfairness. Test subjects who played a game and considered the results unfair, the researchers found, reacted with the exact same instinctive facial expression as those exposed to more straightforwardly disgusting stimuli. Unfairness, it seems, can disgust us.

"People don't make that facial expression in anger," Chapman says, "It's really limited to disgust."

Haidt has done studies in which he primed people to feel disgusted and then asked them to judge the morality of certain actions. In one study, he had some of his unfortunate test subjects respond to four vignettes related to moral judgment while sitting in a room that had been infused with an ammonium sulfide "fart spray." The stink, he found, made them harsher judges, not only of body-related questions like whether first cousins should be able to have sex and marry, but whether people should drive to work when they could walk or whether a movie studio should release a morally controversial film.

In another study, Haidt found an even more dramatic result. Using posthypnotic suggestion, he got his subjects to experience a flash of disgust at neutral words ("take" for half of the experimental group, "often" for the others). They then read a short description of a thoughtful, open-minded student council president named Dan. If the description contained their disgust word, however, the subjects took a deep dislike to Dan, and found reasons to condemn his behavior and justify their aversion, reasons that had no connection to the description they had read — "Dan is a popularity-seeking snob," one said. "It just seems like he's up to something," said another.

To Haidt, all of these results buttress his belief that moral reasoning is simply an after-the-fact story we create to explain our instinctive emotional reactions, in this case a strongly held but arbitrary feeling of disgust. "Moral reasoning is often like the press secretary for a secretive administration — constantly generating the most persuasive arguments it can muster for policies whose true origins and goals are unknown," he wrote in a 2007 paper in Science.

Plenty of psychologists and philosophers are not yet willing to consign moral reasoning to press-secretary status, however. Developmental psychologists in particular have long studied how children and adolescents learn moral behavior, and they tend to be skeptical of claims that behavior is driven by emotions like disgust. To them, arguments like Haidt's wildly overgeneralize from a few suggestive studies.

"What is it that people do day in and day out? They're talking, deliberating, evaluating," says Melanie Killen, a development psychologist at the University of Maryland. In other words, she argues, they're really reasoning. "This is not something only philosophers do. There is tons and tons of evidence in the development literature of the ways that moral reasoning manifests in moral judgments."

To separate out emotion and reasoning as Haidt does, critics charge, simply makes no sense; the two are part of the same tangled process. And Killen points out that much of what Haidt looks at are taboos, some of which can just as easily be understood as beliefs about societal norms as true moral judgments. Even if disgust shapes those social considerations, she says, there's no evidence that it plays a role in broader moral debates.

"Incest, eating your dog — these are not the moral issues of today. The moral issues of today are the Gulf oil spill, the Iraq war, women's rights in the Mideast, child malaria in Africa," she says.

Even among disgust researchers, there are some, like Bloom and Pizarro, who have yet to be convinced that the emotion can shape more abstract moral decisions. "We're obviously disgusted at immoral acts that involve blood or vomit, corporeal things," says Bloom. "It would be more interesting if it turns out that people with high disgust sensitivity have a very different feeling about the tax code."

Haidt concedes that the field is still new, but he sees more and more evidence backing him up. A 2007 study he helped run found that people shown a film about American neo-Nazis not only reported feeling disgusted, but their throats constricted as if they were going to gag and their heart rates dropped. Anger, the other emotion people reported feeling, would have raised their heart rates.

But to David Pizarro, the most interesting — and perhaps most important — question to answer is how flexible disgust is, how much it can change. Fifty years ago, many white Americans freely admitted to being disgusted by the thought of drinking from the same drinking fountain as a black person. Today far fewer do. How did that change? Did their sense of disgust ebb as they spent more time in integrated restaurants and workplaces and buses, or did they find ways to actively suppress their feelings? Pizarro isn't sure, but he'd like to find out.

"So much of this work has just started that there's not a whole lot that's been done," he says. "I think the question is ripe for studying right now."

Drake Bennett is the staff writer for Ideas. E-mail drbennett@globe.com. ■

http://www.boston.com/bostonglobe/ideas/articles/2010/08/15/ewwwwwwwww/

America: Land of Loners?

by Daniel Akst

Americans, plugged in and on the move, are confiding in their pets, their computers, and their spouses. What they need is to rediscover the value of friendship.


Photo by Melinda Taber

Science-fiction writers make the best seers. In the late 1950s far-sighted Isaac Asimov imagined a sunny planet called Solaria, on which a scant 20,000 humans dwelt on far-flung estates and visited one another only virtually, by materializing as "trimensional images"—avatars, in other words. "They live completely apart," a helpful robot explained to a visiting earthling, "and never see one another except under the most extraordinary circumstances."

We have not, of course, turned into Solarians here on earth, strictly limiting our numbers and shunning our fellow humans in revulsion. Yet it's hard not to see some Solarian parallels in modern life. Since Asimov wrote *The Naked Sun,* Americans have been engaged in wholesale flight from one another, decamping for suburbs and Sunbelt, splintering into ever smaller households, and conducting more and more of their relationships online, where avatars flourish. The churn rate of domestic relations is especially remarkable, and has rendered family life in the United States uniquely unstable. "No other comparable nation," the sociologist Andrew J. Cherlin observes, "has such a high level of multiple marital and cohabiting unions."

Oceans of ink have been spilled on these developments, yet hardly any attention is paid to the one institution—friendship—that could pick up some of the interpersonal slack. But while sizzling eros hogs the spotlight these days—sex sells, after all—too many of us overlook *philia,* the slower-burning and longer-lasting complement. That's ironic, because today "friends" are everywhere in our culture—the average Facebook user has 130—and friendship, of a diluted kind, is our most characteristic relationship: voluntary, flexible, a "lite" alternative to the caloric meshugaas of family life.

But in restricting ourselves to the thin gruel of modern friendships, we miss out on the more nourishing fare that deeper ones have to offer. Aristotle, who saw friendship as essential to human flourishing, shrewdly observed that it comes in three distinct flavors: those based on usefulness (contacts), on pleasure (drinking buddies), and on a shared pursuit of virtue—the highest form of all. True friends, he contended, are simply drawn to the goodness in one another, goodness that today we might define in terms of common passions and sensibilities.

It's possible that Aristotle took all this too seriously, but today the pendulum has swung in the opposite direction, and in our culture we take friendship—a state of strong mutual affection in which sex or kinship isn't primary—far too lightly. We're good at currying contacts and we may have lots of pals, but by falling short on Aristotle's third and most important category of friendship, we've left a hole in our lives. Now that

family life is in turmoil, reinvigorating our notion of friendship—to mean something more than mere familiarity—could help fill some of the void left by disintegrating household arrangements and social connections frayed by the stubborn individualism of our times.

Friendship is uniquely suited to fill this void because, unlike matrimony or parenthood, it's available to everyone, offering concord and even intimacy without aspiring to be all-consuming. Friends do things for us that hardly anybody else can, yet ask nothing more than friendship in return (though this can be a steep price if we take friendship as seriously as we should). The genius of friendship rests firmly on its limitations, which are better understood as boundaries. Think of it as the moderate passion—constrained, yet also critical. If friendship, as hardheaded Lord Byron would have it, really is "love without his wings," we can all be grateful for its earthbound nature.

But we live now in a climate in which friends appear dispensable. While most of us wouldn't last long outside the intricate web of interdependence that supplies all our physical needs—imagine no electricity, money, or sewers—we've come to demand of ourselves truly radical levels of emotional self-sufficiency. In America today, half of adults are unmarried, and more than a quarter live alone. As Robert Putnam showed in his 2000 book *Bowling Alone,* civic involvement and private associations were on the wane at the end of the 20th century. Several years later, social scientists made headlines with a survey showing that Americans had a third fewer nonfamily confidants than two decades earlier. A quarter of us had no such confidants at all.

In a separate study, Nicholas Christakis and James Fowler, authors of *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives* (2009), surveyed more than 3,000 randomly chosen Americans and found they had an average of four "close social contacts" with whom they could discuss important matters or spend free time. But only half of these contacts were solely friends; the rest were a variety of others, including spouses and children.

Here, as on so many fronts, we often buy what we need. The affluent commonly hire confidants in the form of talk therapists, with whom they may maintain enduring (if remunerated) relationships conducted on a first-name basis. The number of household pets has exploded throughout the Western world, suggesting that not just dogs but cats, rats, and parakeets are often people's best friends. John Cacioppo, a University of Chicago psychologist who studies loneliness, says he's convinced that more Americans are lonely—not because we have fewer social contacts, but because the ones we have are more harried and less meaningful.

Developing meaningful friendships—having the kind of people in your life who were once known as "intimates"—takes time, but too many of us are locked in what social critic Barbara Ehrenreich has called "the cult of conspicuous busyness," from which we seem to derive status and a certain perverse comfort even as it alienates us from one another. Throw in two careers and some kids, and something's got to give. The poet Kenneth Koch, whose friends included the brilliant but childless John Ashbery and Frank O'Hara, laid out the problem in verse:

You want a social life, with friends.

A passionate love life and as well

To work hard every day. What's true

Is of these three you may have two.

If time is a problem, so is space. Although Americans have been relocating less often lately, perhaps as a result of the recession, we still move around quite a bit—for work, sunshine, retirement, or to be near family—and this process of uprooting dissolves friendships and discourages those that haven't yet formed. Few of us would turn down a tempting new job in a far-off city to stay near friends, possibly for the sensible reason that those friends might move away six months later anyway.

Divorce also takes its toll; most of us over the age of 30 are familiar with the social consequences that ripple outward from a split-up, as foursomes for dinner or bridge are destroyed and friends may find themselves having to pick sides. Marital dissolution usually costs each spouse some precious connections, including in-laws who might once have been important friends.

Our longstanding reverence for self-sufficiency hasn't helped matters. Ralph Waldo Emerson gave us a sharp shove down this road with his famous essay "Self-Reliance," and Cole Porter lyricized the uniquely American claustrophobia that danced off the tongues of a parade of popular crooners: "Let me be by myself in the evenin' breeze/And listen to the murmur of the cottonwood trees/Send me off forever but I ask you please/Don't fence me in." Frontier-oriented American mythology is studded with exemplars of the lone hero, from Daniel Boone to Amelia Earhart, to say nothing of the protagonists of Hollywood westerns such as *High Noon* (1952). Male buddy films date back to Laurel and Hardy, but their profusion in the past three decades—including box-office franchises ranging from *Beverly Hills Cop* to *Harold & Kumar*—is a strong social contra-indicator, like the lavish outfits and interiors of movies made during the Great Depression. If something desirable is missing in life, people like to see it on the screen.

Friendship has also suffered from the remorseless eroticization of human relations that was bequeathed to us by Sigmund Freud. The culture stands particularly ready to sexualize men's friendships since the gay liberation movement mercifully swept away taboos against discussing same-sex relationships. In 2005 *The New York Times* laid claim to coining the term "man date" in a story—under a woman's byline—about the anxiety two straight men supposedly experience if they brave a restaurant or museum together and run the risk that people will think they are gay. The "bromance" theme, once strictly a collegiate sport among scholars scouring the letters of passionate 19th-century friends for signs of physical intimacy, has since made its way into popular culture. The pathetic state of male friendship—and the general suspicion that men who seek close friends might be looking for something more—was captured in last year's film *I Love You, Man,* in which a guy decides to get married, realizes he has no one to be his best man, and must embark on a series of "man dates" to find one.

The irony is that straight men could learn a thing or two from their gay brethren, as Andrew Sullivan implied in his insightful book on the AIDS crisis, *Love Undetectable: Notes on Friendship, Sex, and Survival* (1998). Often estranged from their natural families and barred from forming legally acknowledged new ones of their own, gay men, Sullivan observed, learned to rely not on the kindness of strangers but the loyalty of friends: "Insofar as friendship was an incalculable strength of homosexuals during the calamity of AIDS, it merely showed, I think, how great a loss is our culture's general underestimation of this central human virtue."

We make this mistake in part because we've allowed our wildly inflated view of matrimony to subsume much of the territory once occupied by friendship. Your BFF nowadays—at least until the divorce—is supposed to be your spouse, a plausible idea in this age of assortative mating, except that spouses and friends fill different needs, and cultivating some close extramarital friendships might even take some of the pressure off at home. Yet the married men I know seem overwhelmingly dependent on their wives for emotional connection, even as their wives take pleasure in friends to whom they don't happen to be wed. The Beatles' immortal lonely heart Eleanor Rigby and novelist Anita Brookner's socially isolated heroines notwithstanding, the fact is that

all the women I know are better at friendships—spend more time on them, take more pleasure in them, and value them more highly—than any of the straight men.

Forgive me, guys, but we are lousy at this, and while it may seem to us that our casual approach is perfectly normal, in fact it's odd. Among people whose lives are more like those of our ancestors, for example, friendship is taken far more seriously. In some cultures, close friends pledge themselves to one another in bonding rituals that involve the spilling of blood. The Bangwa people in Cameroon traditionally considered friendship so important that many families assigned a best friend to a newborn right along with a spouse.

There was a time when platonic friendship was exalted—if not idealized—in the West, perhaps in part because of religious paranoia about sex. The myth of Damon and Pythias and the biblical story of David and Jonathan resonated across the centuries, and in the Middle Ages knights bound themselves in ceremonies to comrades in arms. Cicero, Johann Wolfgang von Goethe, Sir Francis Bacon, Michel de Montaigne, William Wordsworth—the list of Western luminaries who have waxed rhapsodic over friendship is long enough to fill anthologies from both Norton *and* Oxford.

In the 19th century, friendship was the subject of panegyrics by the likes of Emerson, who wrote that "the moment we indulge our affections, the earth is metamorphosed: there is no winter and no night: all tragedies, all ennuies vanish." His buddy Henry David Thoreau, lamenting that to most people a friend is simply someone who is not an enemy, declared, perhaps wishfully, "Friends do not live in harmony, merely, as some say, but in melody." Mary Wollstonecraft might have spoken for the lot when she noted that while eros is transient, "the most holy bond of society is friendship."

A grain of salt is in order: Friendship, like baseball, always seems to send intellectuals off the deep end. Yet there is more biological justification for our predecessors' paeans to friendship than for our modern-day tepidity. Friendship exists in all the world's cultures, likely as a result of natural selection. People have always needed allies to help out in times of trouble, raise their status, and join with them against their enemies. It doesn't seem much of a stretch to conclude that a talent for making friends would bestow an evolutionary advantage by corralling others into the project of promoting and protecting one's kids—and thereby ensuring the survival of one's genes.

If we evolved to make friends, we also evolved to tell them things. Humans have an irrepressible need to divulge, and often friends can tell one another what they can't tell anyone else, a function that has come in especially handy since the Protestant Reformation put so many beyond the reach of the confessional. Less grandly, trading gossip is probably one of the main reasons people evolved into such friend makers, since information (and reputation) have always been valuable—even in the evolutionary environment.

Alliances and inside dope are two of the ways people derive power from friendships, which is why tyrannies are sometimes so hostile to them. Private affiliations of all kinds are a countervailing force against the great weight of government, but Aristotle reminds us that friendship also maintains the state. Friendships, after all, entail mutual regard, respect for others, a certain amount of agreeableness, and a willingness to rise above the ties of kinship in order to knit society into a web of trust and reciprocation—qualities more likely, in a state, to produce Denmark than Iraq.

Living in a society of friends has many advantages. Friendship can moderate our behavior (unless, like the television mobster Tony Soprano, you happen to choose immoderate friends). Friends help us establish and maintain norms and can tell us if we're running off the rails when others don't notice, won't break the news, or lack the necessary credibility. Both our relatives and our friends, the psychologist Howard Rachlin writes,

"are essential mirrors of the patterns of our behavior over long periods—mirrors of our souls. They are the magic 'mirrors on the wall' who can tell us whether this drink, this cigarette, this ice-cream sundae, this line of cocaine, is more likely to be part of a new future or an old past."

Indeed, the influence of friends and associates is profound. Social scientists Christakis and Fowler, working with data from the multidecade Framingham Heart Study, found that if you become obese, the odds increase by 71 percent that your same-sex friend will do likewise—a bigger impact than was measured among siblings. On the other hand, when you become happy, a friend living within a mile has a 25 percent greater chance of becoming happy as well—and even a friend of a friend has a 10 percent greater chance. Encouragingly for those who know a sourpuss or two, misery was not comparably contagious.

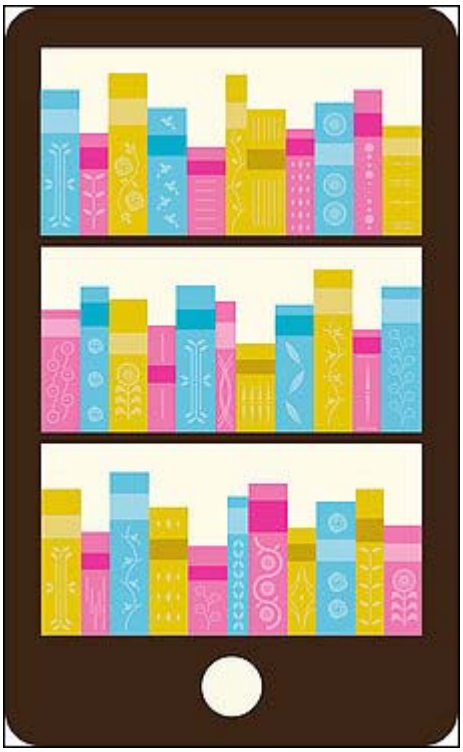
Friendship can even prolong our lives. For loneliness, the experts tell us, has to do more with the quality of our relationships than the quantity. And we now know that loneliness is associated with all sorts of problems, including depression, high blood pressure and cholesterol, Alzheimer's disease, poor diet, drug and alcohol abuse, bulimia, and suicide. Lonely people have a harder time concentrating, are more likely to divorce, and get into more conflicts with neighbors and coworkers.

But of course friends are not vitamins, to be taken in daily doses in hopes of cheating the Grim Reaper. The real reason to prize our friends is that they help us lead good and satisfying lives, enriched by mutual understanding. This special way of knowing one another was once exalted as "sympathy," and Adam Smith described it as "changing places in fancy." As Caleb Crain made plain in his excellent book *American Sympathy: Men, Friendship, and Literature in the New Nation* (2001), the 18th and 19th centuries were the heyday of sympathy, when the fervor of friends was evident in their letters as well as their comportment. Sympathy persisted in popular discourse and was studied as a scientific fact under various guises until, in the 19th century, Charles Darwin came along to replace cooperation with competition in the intellectual armament of the day.

Sympathy's long-ago advocates were onto something when they reckoned friendship one of life's highest pleasures, and they felt themselves freer than we do to revel in it. It's time for us to ease up on friending, rethink our downgrade of ex-lovers to "just" friends, and resist moving far away from everyone we know merely because it rains less elsewhere. In Asimov's vision, Solaria was a lonely planet that humans settled with the help of robots. People weren't made to live there.

http://www.wilsonquarterly.com/article.cfm?AID=1631

As electronic readers gain popularity, what happens to the personal library?



By Philip Kennicott
Washington Post Staff Writer
Sunday, August 15, 2010

A few years ago I spent a weekend at a gaudy trophy home in the Hamptons where, to paraphrase an English pop song, the crowd was blond and beautiful and the conversation dull and dutiful. I escaped to a room that was called the library, not because anyone ever read there but because it was quiet and filled with books. From its shelves I took a copy of a Shakespeare play that I had mostly forgotten, and sat down in one of the comfortable-looking red-leather armchairs. It was like descending into a low-slung sports car. Down and down you went and when you finally hit bottom, your knees were higher than your backside.

Later I learned that this was because the bottom of the chair legs had been sawed off, as had the legs on all the coffee tables, so that when the room was photographed from certain angles, the walls of books looked even higher by contrast. This deceitful bit of interior design could stand for the whole house. It was all about display.

Not many of us can afford a library like that one, a designated room entirely full of books, arranged floor to ceiling on custom-made, built-in shelves capped by ornate molding. But while most of us would never claim to have a home library -- too pretentious -- we secretly think of some room in the house as . . . the library. A place to read, to store books, to confront the past and future of our own limited knowledge, staring down at us in all its complicated categories: books you will read, books you should read, books you read and remember, books you read and forgot, lousy books your aunt gave you and you can't throw away because she still comes to visit from time to time.

The architecture of our lives is constantly changing, and the library may be next on the list of rooms that grow vestigial and then vanish from our floor plans. Where it survives, it has merged with the "office" or the "den," and the language of the contemporary home, which stresses flow and openness, doesn't bode well for the survival of a room that should stand apart, a quiet eddy to the side of the busy torrent of modern life. The library, alas, may go the way of the separate dining room and the formal parlor, not because we won't read anymore, but because we won't read books anymore, at least not books printed on paper.

But what a loss to the ways books represent, bedevil and impeach us. They represent us, of course, as anyone knows who has made basic decisions about which books go in the living room and which get confined to less public places. That they bedevil us is clear if you have moved recently or live burdened with closets filled with books -- books under the bed, books in the attic -- or if you have ever saved a book for years or decades only to discover, upon desperately needing it, that it has been lost in the general deluge of too many books. But they also impeach us, and it is that function that electronic readers can never replicate. A wall of books is mortality made geometric, a pattern of hope and loss, ambition and failure. There's so much fraud lurking on our shelves, fraudulent books such as "My Sister and I." Purported to be by Nietzsche, it is suspiciously more readable, lurid and fun than anything by Nietzsche. But there's also the record of our own fraud, the books we intend to read but never will, the books of which we remember no more than what is printed on the dust jacket -- yet claim to possess in some deeper way.

There are books we pretend to keep for reference, but in fact keep only because they look so damn fine on the shelf. And then there are the books where should-have-read blends with may-have-read, and we're too embarrassed to confess we can't remember which is the case ("Catcher in the Rye"). There are also the books of hollow triumph, the great tomes of philosophy read in college, which remain on the shelves like snapshots taken from the summit of Everest or like pants in the closet that will never again slide up our thighs without tearing.

Electronic book readers are a great invention for people who actually read books. But what do they offer those of us who have an even more complicated relationship with books unread? Sitting on a shelf, Thomas Mann's "Magic Mountain" stares down as coldly and harshly as an alp in winter. Locked up in the digital ether of a Kindle or a Nook, it can never indict our miserable laziness.

The home library may live on in a few privileged homes as a purely fraudulent place, a room, like that one in the Hamptons, for displaying books that are entirely decorative. But all the lesser lies of reading, the smaller acts of fraud, the minor and more nuanced forms of self-deception that are manifest in a home library will lose their designated place, their little plot of space in the three-dimensional world. No one will ever look at an iPad icon that says "The Man Without Qualities," sitting on a high-definition digital picture of a bookshelf, and think, "After I'm dead."

http://www.washingtonpost.com/wp-dyn/content/article/2010/08/12/AR2010081206624.html?wprss=rss_print/style

The Promise and Peril of 'Smart' Keyboards

By VIRGINIA HEFFERNAN

Analog culture is stored in our muscle memories. Even as artifacts of the predigital world disappear, we haven't forgotten the moves. How to crank up a car window. How to ease up on a clutch. How to put a needle on a record. Among the 20th-century activities our muscles can't forget is typing on a qwerty keyboard. And though most people who type now don't know the meaning of a typebar jam — much less the inky aggravation — the configuration of characters that begins with the row q-w-e-r-t-y-u-i-o-p, first marketed for typewriters in 1874 to reduce such jams, is still the most common configuration in the world for English-language keyboards.

For 136 years, then, typing in English has meant making certain neurological associations. Words exist in our minds and on our tongues, but they also live in our hands and fingers. Anyone who types envisions and feels words in space, and for English speakers who use technology, this space is defined by the qwerty keyboard. Who knows what qwerty has done to the language — even to modes of thought — by attaching meaning to certain constellations? Deep in our typist-minds, G and H are centrally located and somehow siblings; X and Z are southwestern outliers; and Q is always followed by . . . W.

But maybe qwerty is finally on its way out. This will be good news to many designers who believe that bullheaded commitment to qwerty is holding up a revolution in interface design that should have started with the touch screen. The trusty layout still appears on nearly all English-language typewriters, computers and smartphones with hardware keyboards, but smartphones and tablet devices with touch-screen keypads (like the Android and the iPhone) now default to a layout that *looks* like qwerty but doesn't work like qwerty at all.

I first discovered the implications of a gut-renovated qwerty while using Google on the iPad. When you're about to enter a search term, an abbreviated keypad that features the qwerty configuration of letters appears. But instead of the word "Return" or "Enter" on the big key midway down the right side of the keypad, the key reads "Search." That's quietly amazing. The keypad changes under your fingers. The same is true when you type in the "To" and "Cc" field of the iPad's Mail program. Suddenly the @ sign is prominent on the keypad, as well as the hyphen and underscore, two symbols common in e-mail addresses. Similarly, when you're typing into the address bar of the Safari browser, the custom keypad that comes up features no spacebar — spaces don't go into Web addresses — and there's a new, freestanding ".com" key.

The iPad keyboard, like other touch-screen keyboards, is also elaborately "chorded." Press one designated key, and the whole keyset changes. One board has qwerty letters and first-tier punctuation (comma, period), a second board is numbers and second-most-used punctuation (semicolon, parentheses) and a third is important symbols (dollar sign, percent sign).

Skills with qwerty won't help you with such sophisticated chording; you'll have to learn to type again. In fact, the chording produces so many possibilities and the keys are so shape-shifting that the technology press produces guides with names like "71 iPad Keyboard Keys You Probably Didn't Know Existed."
Preserving signifiers from the analog world while changing their meaning — having touch-screen displays that look like keys but are really responsive mini-apps — introduces excitement but also unease. I discovered this while playing an online board game on PBSkids.org called Bring It. The game offers players a chance to advance by answering basic math questions on cards that seem to come from a deck.
My kindergartner son and I have played Bring It dozens of times. For a board game, it's remarkably tear free. It always delivers a satisfyingly close finish; no one ever gets trounced in Bring It. I came to suspect the reason: the deck of cards is rigged. If a player answers math questions correctly, the deck changes so he will draw more-challenging cards and stay interested. A player who misses questions doesn't draw the hard cards so he won't become frustrated. With the deck rigged in this charitable way, the players generally cross the finish line almost together.
By e-mail, Laura Nooney and Gentry Menzel, who have worked on Bring It, told me that this and many other games on PBSkids.org are programmed to be "self-leveling" and rise or fall in difficulty depending on the histories of the players.
"In a virtual-game environment," Nooney and Menzel wrote, "we know the behavior and pattern of success of our players and can cater the game to the needs or level of challenge most appropriate for that individual player." Referring to the Bring It flash cards, they said that "the game knows whether you've answered a particular question correctly and will only give you the next most difficult question in that category if your answer was correct." (On the phone, Kevin Lesniewicz, the lead developer of the game, said of Bring It, "It's like a simple form of artificial intelligence.")
Like the "Enter" key that becomes a "Search" key, the self-leveling card deck may at first seem trivial. But it's also a sly way that digital technology that uses real-world iconography destabilizes experience. What, after all, is a more recognizable symbol of the capriciousness of life than a deck of cards, out of which your fate is randomly dealt? And yet here the deck icon is only superficial. At heart it's not a random-card generator but the opposite: a highly wrought program with a memory, an algorithm and a mandate to keep children in the game. An app posing as a spatiotemporal object.
As a populous commercial precinct, the Web now changes in response to our individual histories with it. Like a party that subtly reconfigures with each new guest, the Web now changes its ads, interfaces and greetings for almost every user. Some people find this eerie. But it's nowhere near as shiver-worthy as the discovery that digital "things" — apps carefully dressed as objects — change as we use them, too. And it's weird enough when those things are being solicitous and cooperative. What if the keyboards and decks of cards all turn on us? Let's not think about that, not yet.

A HIGHER KEY

Ready to quit qwerty? For the Android, try **Swype**, which lets you slide fingers from letter to letter instead of jabbing them, or **ThickButtons**, which enlarges needed keys as you go. Demos of these and related programs are at **swypeinc.com** and **thickbuttons.com**.

ARTIFICIAL LUCK

Games that challenge kids' brains without breaking their hearts are not easy to find. The games at **PBSkids.org** are designed to "**prevent boredom and frustration**," meaning what looks like good luck might be a PBS guardian angel in the machine.

PICTURE THIS

Hey, you don't need qwerty if you give up words altogether. Try the highly visual language of **icon messaging** with awesome apps like **Emoji** or **Zlango**: a guy with a Pinocchio nose means "deceive"; a guy with spread arms means "much."

http://www.nytimes.com/2010/08/15/magazine/15FOB-medium-t.html

264 Japanese Carvings, Revealing Family History

By EVE M. KAHN

The British ceramicist Edmund de Waal will promote his memoir, "The Hare With Amber Eyes: A Family's Century of Art and Loss" (Farrar, Straus & Giroux), during a two-week tour of the United States this fall. But he will be able to bring along only a few of his favorite pocket talismans: Japanese carvings called netsuke, the size of walnuts, depicting animals, fruit, peasants, samurai and erotica.

They are mostly made of ivory, and sometimes boxwood, and only the wooden ones can officially be stuffed into his luggage. "You're not allowed to carry ivory out of the country," Mr. de Waal said in a recent phone interview.

His book revolves around 264 netsuke, which have been handed down in his family for four generations. Mr. de Waal, who creates monochrome cylindrical vessels for a living, took a few years' break to riffle through family archives and to travel abroad 20 times for research. He has learned that the collection was displayed alongside Impressionist and old master paintings during the last 140 years, and he discovered who protected it from wartime theft.

Mr. de Waal, 45, keeps the carvings in a mahogany-and-bronze display case near the sitting-room piano at his Edwardian town house in London. The case is unlocked, so his school-age children can play with the netsuke. He has found out that his immediate ancestors, Jewish grain tycoons from Odessa named Ephrussi, were allowed similar access when they were young.

The netsuke at first belonged to Charles Ephrussi, an art historian who settled in Paris and spent part of his inheritance on paintings by his friends Degas and Renoir. He also knew Proust and helped inspire the character Charles Swann; the fictional and real aesthetes, Mr. de Waal writes, were "both experts in the arcane subject of Venetian 15th-century medallions."

In the 1870s Mr. Ephrussi and his married lover, Louise Cahen d'Anvers, started collecting Japanese ivory and lacquer. In their intellectual circles, a British journalist reported at the time, Japonisme had become "a sort of religion." Mr. Ephrussi eventually switched obsessions to French furniture, and in 1899 he gave the netsuke collection as a wedding present to his cousin Viktor von Ephrussi of Vienna, who married Baroness Emmy Schey von Koromla.

They are Mr. de Waal's great-grandparents. He has visited their 1870s Ringstrasse palace, now a casino chain's offices. Behind its facade's turrets and caryatids, the rooms are still filled with the original marble paneling and gilding. In the baroness's dressing room, Mr. de Waal learned, she arranged the netsuke in a black lacquer case lined with green velvet.

Her four children would play with the carvings on the pale yellow carpet and organize them by color and size. From a child's viewpoint, Mr. de Waal writes, "there are so many that you can never really count them, never know that you have seen them all."

The family fled the country when the Nazis seized the palace, turning it into an ideological education and indoctrination office. The baroness committed suicide a few months later, and her survivors scattered to England, Mexico and the United States. In late 1945 Mr. de Waal's grandmother Elisabeth, who lived in Tunbridge Wells, England, visited Vienna. American soldiers, who were using the palace as a "property control subsection" office, told her that the family maid Anna still lived there.

Anna's last name was not recorded. But Mr. de Waal does know that while the Nazis were spending weeks cataloging and boxing up the Ephrussis's porcelain, silver and old masters, Anna pocketed a few netsuke a

day and stashed them under her mattress. When Elisabeth came back, Anna announced, "I have something to return to you." So the 264 netsuke traveled to England.

This fall Mr. de Waal's book will be published in Austria, and he said he hopes it will lead to the identification of Anna. "She's someone's great-aunt or great-great-aunt," he said. "There's going to be some trace."

He first saw the netsuke as a teenager while visiting Tokyo, where his great-uncle Ignace worked for a Swiss bank. Ignace kept the netsuke in a glass case at his Modernist house and let dealers and scholars study them. Mr. de Waal, who inherited them a few years ago, describes his London home as "the collection's latest resting place."

The rows of netsuke have influenced his ceramic work; he often groups his pots by color and size on museum and gallery shelves, like minimalist repeating brushstrokes. Viewers who know about his inheritance, he said, have told him: "Diasporic objects! You're keeping your objects together, aren't you?"

HEY, KIDS! AUCTION TIME!

After five decades of acquiring political, television and sports memorabilia, Neil Robert Sakow is starting to sell the collection that he kept open to the public as Neil's American Dream Museum in West Hartford, Conn. On Saturday, Lloyd Ralston Gallery in Shelton, Conn., will auction a few hundred of Mr. Sakow's objects, specifically mid-20th-century Howdy Doody artifacts.

With estimates mostly up to $100 each, the Ralston lots show that freckled puppet's image molded or printed on lampshades, sandbox toys, towels, vinyl chairs, key chains, food packages and life preservers. "It's the Howdy Doody lifestyle, every insane little product he endorsed," Glenn Ralston, the auctioneer, said.

Mr. Sakow, 65, said in a recent phone interview that he may open a downsized version of the museum in a few months. If that happens, he said, he will entertain tourists with his latest collection: he has memorized dozens of 1950s and '60s advertising jingles. During the interview he gave a demonstration, rattling off songs for Colgate, White Owl cigars and Texaco ("We work from Maine to Mexico").

ENGLISH CERAMICS SALE

English ceramics makers in Staffordshire and Liverpool started catering to Americans even before the Revolution was over. They emblazoned slogans like "E Pluribus Unum" and images of George Washington and United States warships on cream-color jugs, bowls, plates and teapots.

For five decades these products fascinated S. Robert Teitelman, a lawyer in New Jersey who died in 2008. He helped research and finance a book, "Success to America: Creamware for the American Market, Featuring the S. Robert Teitelman Collection at Winterthur" (Antique Collectors' Club), which was released in April, and donated 60 pieces to Winterthur Museum in Delaware, where they are on view through Oct. 4. Northeast Auctions in Portsmouth, N.H., has been selling the rest of the collection and will offer the last batch on Aug. 22.

About 50 Teitelman lots at Northeast are painted or printed with eagles, ships, politicians and gung-ho inscriptions like "peace, plenty and independence." The Winterthur book will serve buyers as a kind of auction catalog supplement, showing how designs and glazes recur in the collection, now scattered.

http://www.nytimes.com/2010/08/13/arts/design/13antiques.html?ref=design

Sunny Scenes, Direct From Pyongyang

By MICHAEL Z. WISE

VIENNA

"WHY?" is the question Peter Noever, the director of the Museum of Applied Arts here, says he is constantly asked about a sprawling exhibition of propagandistic North Korean artworks now on view. The show has garnered condemnation and suspicion since it opened in May, just as international tensions flared over North Korea's alleged sinking of a South Korean naval ship.

The exhibition encompasses more than 100 oil paintings and watercolors from North Korea's national museum, known as the Korean Art Gallery Pyongyang, as well as architectural drawings and models. This is the first time that secretive totalitarian state has sent a large number of its artworks outside its sealed borders. Until now the country's cultural proclivities have been known to the outside world primarily through television broadcasts of bizarrely choreographed dancing and gymnastics extravaganzas performed by up to 100,000 adults and children. The Vienna show gives another, somewhat more intimately scaled perspective on the controlled aesthetics of a dystopia where many citizens must scavenge for food and are subject to forced labor, torture and other repressive measures.

A cotton-candy palette predominates in the eerily upbeat paintings, whose high technical proficiency is matched by a severely limited range of subjects. Dutiful farmers, steelworkers, street sweepers and seamstresses all beam with joy; well-nourished children laugh in dazzling sunlight. "We Are the Happiest Children in the World" is one surreal title. An image from 2000 — just after the peak years of a famine estimated to have cost three million lives — depicts the portly dictator Kim Jong-il lifting the lid off a steaming pot in a kitchen laden with succulent meats and fruits as two white-toqued chefs and an army officer

stand by. “The Supreme Commander Kim Jong-il Deeply Concerned Over the Soldiers’ Diet,” reads the caption.

The bulk of the exhibition comprises art created in the last 10 years. These blissful landscapes, street and domestic scenes are hung in open galleries, but monumental depictions of Kim Jong-il and his father — the “Great Leader” Kim Il-sung — are tucked away in roped-off alcoves where guards prevent visitors from getting close. “We’re here to make sure the pictures won’t be damaged,” a guard said.

Along with protecting what are considered North Korean national treasures, the museum is doing everything possible to avoid offending the lending nation. The exhibition and 229-page catalog are devoid of any critical text referring to the content of the pictures or the political context in which they arose. A symposium involving specialists in North Korean art and politics has been scheduled, but only on the eve of the exhibition’s closing on Sept. 5.

“It’s totally clear that if we were to have contextualized this exhibition, as some wanted us to, the exhibition would not have taken place,” Mr. Noever conceded in an interview. While North Korea’s minister of culture wrote in the catalog that he hopes the show will contribute to “deepening mutual understanding” and exchange, the museum in Vienna said North Korea refused to allow any of the featured artists to travel to Austria .

“Is it ethical to show the propaganda works of a dictatorial regime?” a correspondent from the former East bloc asked the exhibition’s curator, Bettina M. Busse, at a press preview on May 18. Under the glare of camera lights, Ms. Busse told Czech Television: “There seems to be a misunderstanding of the topic. We’re concerned with culture.” The German newspaper Die Welt disagreed, condemning the exhibition, “Flowers for Kim Il-sung,” as “obscene.” The paper said that in a “terror regime” like North Korea there is “no perceptible visual art according to an acceptable understanding of any sort.”

The North Koreans themselves had trouble grasping the appeal of their artwork to the Viennese. “They didn’t understand it for a long time,” Mr. Noever said. “What interests me are artists who are apart and little-known cultures to which one has little access and about which one has little information.” Arranging the exhibition involved four visits to Pyongyang starting in 2003 and protracted negotiations, he said. No money was paid for borrowing the works.

Just three days before the exhibition opening, North Korea’s ambassador to Austria came to Mr. Noever’s office to ask once again why he was putting on the show. “There were anxieties,” Mr. Noever said. “The North Koreans feared it was propaganda against North Korea.”

Many Austrians, meanwhile, have accused Mr. Noever of burnishing the image of the regime in Pyongyang. The Austrian finance ministry, which usually provides insurance protection on art loans from abroad to government-supported museums like Mr. Noever’s, refused to do so for this show. “This exhibition shows a covert sympathy,” said a ministry spokesman, Daniel Kapp, “and the finance minister decided we will not contribute.”

Mr. Noever provoked further furor with his catalog essay lamenting that “our Western ideological lenses cloud, if not entirely distort, the view of other realities” and urging museumgoers to “bid farewell once and for all to Eurocentric and culturally imperialistic attitudes.” The show, he argued, “proves that cultural differences can be bridged with mutual respect.”

As museum director for the past 24 years, Mr. Noever has demonstrated a flair for attention-getting projects. He brought in Jenny Holzer and Donald Judd to energize the displays of Biedermeier furniture, Mamluk carpets and assorted applied arts in what had become a fusty storehouse founded as an imperial entity in 1864; organized surveys of Soviet art; opened an art center in Los Angeles; and is seeking to transform one of Vienna’s Nazi-era antiaircraft towers into a contemporary art space. “Noever is no fool,” the Viennese daily Die Presse said of the North Korean spectacle, “but rather the leading Austrian exemplar of leftist radical chic.”

The show is unlikely to win North Korea any new adherents abroad, but many Korea experts concur it may help promote dialogue, albeit limited. “It is important to engage in cultural projects with different countries, even if the regime is one we might not like,” said Jane Portal, who heads the Asian department at the Museum

of Fine Arts, Boston, and is the author of a book on North Korean art. “Engagement is better than total lack of communication.”

Even though Austria backs sanctions against Pyongyang to deter its nuclear arms buildup, Vienna apparently retains a special allure for the North Koreans. It long served as a base for shopping sprees to supply the North Korean elite with luxury goods, according to a memoir by a North Korean colonel who oversaw such purchases before defecting to Austria and publishing the book in March. Last year Italian police blocked an Austrian intermediary from buying two yachts for Kim Jong-il. Yet it’s not just shopping that North Koreans seem to like about Vienna. In the last decade Pyongyang sent 17 students to the renowned University of Music and Performing Arts to learn to conduct.

The Vienna museum has in turn repaid the North Korean affection with a tongue-in-cheek exhibition title relating to the use of flowers to glorify the North Korean leadership. In 1965 President Sukarno of Indonesia presented Kim Il-sung with a hybrid orchid named Kimilsungia. Then a new type of begonia bred in 1988 was named Kimjongilia after the current leader and called the “immortal flower.” Festivals devoted to these blossoms are held regularly in North Korea. At the Vienna exhibition sprays of artificial silk Kimilsungia and Kimjongilia adorn the entry.

“The North Koreans don’t get the irony of it,” Ms. Portal said of the florid title, which “many people who look at the exhibit think it’s a bit of a joke.”

“However much we may think of it as a joke or odd,” she said, “we’ve seen it all before in terms of communist and totalitarian societies — from the Soviet Union to the Nazis to China. This is the last remnant of that, the last bastion of this kind of thinking that’s bound to disappear. That’s why it’s so important for it to be seen and collected for posterity.”

http://www.nytimes.com/2010/08/15/arts/design/15noko.html?ref=design

A Compendium of Everyday Genius
By ALICE RAWSTHORN

LONDON — The Rev. Samuel Henshall was not a lucky man. His hopes of academic glory in late 18th century Oxford were scuppered when his scholarly essays flopped, and he failed to bag a professorship. He began a new career in the church only to be dogged by legal tussles over money, or the lack of it. Once he was taken to court by a brewery to which he owed £420 — a hefty beer bill for the time.

But his boozing wasn't entirely wasteful, because it inspired Mr. Henshall's sole success. He invented a contraption to extract corks from wine bottles, the corkscrew, which was patented by the industrialist Matthew Boulton in 1795. Despite his failure to pay his share of the patenting expenses and a flood of complaints from rival inventors (one of whom dismissed him as a "piratical screwmaker") Mr. Henshall is still credited as the corkscrew's designer. Several of his early models were buried with him.

A modern version of his invention is displayed together with a paper clip, clothespin, rubber band, egg carton, shipping container and 30 other useful and familiar objects in "Hidden Heroes: The Genius of Everyday Things," an exhibition opening Friday at the Vitra Design Museum in Weil am Rhein, Germany.

"They're the sort of products that every designer dreams of making — very simple, very ingenious items that we use on a daily basis," said Jochen Eisenbrand, who curated the exhibition. "They've continued to exist for decades without changing very much, because they haven't needed to."

Some of the objects in the show were devised by amateur inventors like the hapless Mr. Henshall. One is the glass preserving jar, a forerunner of the tin can, which was dreamed up in 1809 by a Paris chef, Nicolas Appert, as the winning entry of a competition launched by Napoleon Bonaparte to improve the French Army's food. Another is the clothes hanger, which dates back to 1903 when Albert J. Parkhouse arrived for work at a lampshade frame factory in Jackson, Michigan, only to find that all of the coat hooks were taken. He made something to hang his coat on by bending a piece of wire into an elongated triangle and twisting the ends into a hook.

Other "Hidden Heroes" stemmed from sudden flashes of inspiration. The German pharmacist Maximilian Negwer hit upon his 1907 idea of cushioning wax ear plugs with cotton wool when reading Homer's "The Odyssey." Untangling burrs from his dog's fur after an Alpine hunting trip prompted the Swiss engineer George de Mestral to develop Velcro fabric fastener in the 1940s and 1950s.

Air bubble film, or bubble wrap, was conceived in the 1950s after a Swiss inventor, Marc Chavannes, noticed how the clouds seemed to cushion an airplane as it descended, and realized that a similar effect could be achieved in packaging by sealing air inside plastic film. An American scientist, Art Fry, dreamed up the Post-

it note in the late 1970s when singing in a church choir. He couldn't find the right page in his hymn book because the paper bookmark kept slipping out.

The exhibition also shows how some familiar objects are industrialized versions of homemade devices that evolved over centuries. The baby pacifier dates back to the scraps of cloth filled with sugar, which soothed agitated babies in the 1500s. The design of the rubber condom was based on the cloth bags and animal intestines that had historically been used as makeshift contraceptives.

Intriguing though the stories behind these "Hidden Heroes" are, many of them have been told before. (Although to the Vitra Design Museum's credit it has unearthed patent drawings, industrial films and early advertising campaigns to document how they were designed, manufactured and marketed.) Similar objects featured in 2004's "Humble Masterpieces" exhibition at the Museum of Modern Art in New York and "Super Normal," a 2006 show organized by the British designer Jasper Morrison and his Japanese counterpart, Naoto Fukasawa. Some re-emerged last year in "Design Real," an exhibition curated by the German designer, Konstantin Grcic, at the Serpentine Gallery in London.

Why do we find them so fascinating? The stories help, obviously, especially the ones with "it could have been you" sub-plots. Take the German housewife, Melitta Bentz, who made a fortune by inventing the coffee filter in 1908, after experimenting with blotting paper from her son's school exercise book.

It's equally tantalizing to be able to think of familiar things, especially useful and inexpensive ones, as being unexpectedly interesting. "We all find these objects irresistible because they give us a sense of adventure and discovery," said Paola Antonelli, senior curator of architecture and design at the Museum of Modern Art, who organized "Humble Masterpieces." "It is a great worldwide treasure hunt, which is open to everyone with no need for star designers or erudite curators."

The modesty of the "Hidden Heroes" is particularly appealing at a time when we've become bored by the brashness of what's been called "Design-with-a-capital-D." (Remember the lamp mounted on an 18-karat-gold-plated Kalashnikov AK-47 assault rifle by the French designer, Philippe Starck? That was the peak/nadir of "Design.") Designers, the thoughtful ones, at least, are increasingly absorbed by the ontology of objects, or the abstract qualities that define them, rather than aesthetics.

It's also easy to see why we should treasure economy, pragmatism and longevity in a deepening environmental crisis. Though one object in both "Hidden Heroes" and "Humble Masterpieces" doesn't quite fit that picture. It's the incandescent lightbulb, which embodies the utilitarian virtues of cheapness, practicality, simplicity and so on, except when it comes to energy. Only 15 percent of the electricity it consumes is used to create light; the rest disappears as heat.

The lightbulb industry has spent a fortune developing energy-efficient alternatives, but so far none has matched the warm, soulful light that makes the incandescent bulb so special. And unless one succeeds, it won't qualify as a design "hero," hidden or otherwise.

http://www.nytimes.com/2010/08/16/arts/16iht-design16.html?ref=design